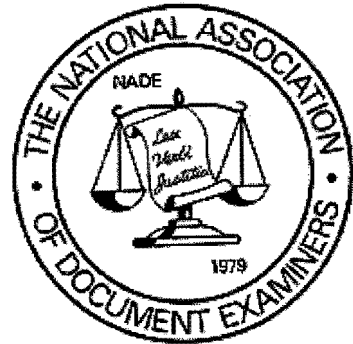


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Journal of The National Association of Document Examiners



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JOURNAL OF THE NATIONAL ASSOCIATION OF DOCUMENT EXAMINERS

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Editorial

Welcome to this edition of the Journal, which commemorates our 25th year as the National Association of Document Examiners.

This edition is dedicated to our two Founders Phyllis Cook, CDE, Diplomate and Renee Martin, CDE, Diplomate. Their foresight and determination made possible the strong organization we now enjoy and admire. The organization has grown from a handful to over 130 members.

Phyllis and Renee first meet in 1977 while Renee was hosting a four hour radio program on Princeton's WHWH. Renee was already an established document examiner and Phyllis was just entering the field of forensics. They both recognized the clear need for an organization for private examiners. Therefore in 1979, they decided to start their own organization that would be open to both professionals and students of document examination. On April 28, 1979, Renee and Phyllis met together with Phil's work partner, Paul Stauffer, and began to form the organization. They first selected the name. As they did not want to limit the scope of the organization, they decided on the word "National" with the logical following of "Association of Document Examiners."

Their first order of business was to mail invitations to others who might be interested in joining them at their first organizational meeting in Princeton, New Jersey.

On July 5, 1979, Martin and Cook welcomed to this meeting, Daniel B. and Florence Anthony, Karl and Rita Aschaffenburg, Flo Cook, Irene Setlak, Paul Stauffer, Herry Teltscher, Rita Cole, Marie Dooney and Albert and Geraldine Yokum.

The group decided to hold a seminar with the idea of inviting several hundred people. Renee and Phyllis stated that "hundreds came", many joined and they felt they were on their way.

From that initial group, several well-known individuals joined Cook and Martin, Rita and Karl Aschaffenburg, Karl Aschaffenger, Irene Setlak, Paul Stauffer, Herry Teltscher, and Norman Werling. It took them a year of weekly meetings to develop the organization. The official incorporation was in 1979 and the first Journal was published in May 1980. The beginning lines of the "Founder's Message" in that first issue still proudly ring true: "We, who watched it develop from a dream, are justifiably proud. The Association holds something for everyone from the most qualified professional to the beginning student."

So, thank you Phyllis Cook and Renee Martin. Thank you for creating an organization that serves its membership just as you hoped it would back in 1979. In every respect, the organization has fulfilled the Founders' original goal of providing services to its members to foster personal growth and professionalism. This is demonstrated daily in the NADE Forum, which through networking provides answers to questions about technical issues, ethics and resources. This same attitude of sharing is further shown in the NADE Chatroom, Communiqué and annual conferences. How proud our Founders must be to see how the organization has grown and evolved. And how proud we are too of our esteemed Founders.

This issue contains numerous informative articles on a myriad of issues document examiners face everyday. Kay Micklitz's article about Parkinson's and handwriting will certainly

assist all of us who are examining handwriting of an ever-increasing senior population.

Willa Smith's article addresses the issue of disguise through other-hand writing with some interesting results from her investigation of anonymous letters at a business. The article also includes a test to see if you can match the dominant-hand printing with the non-dominant hand printing from request writing of the employees obtained during her investigation.

Jacqueline Joseph's article also addresses the topic of opposite-hand writing, with a second article of an extensive annotated bibliography on the subject.

The article by John Cerlanek provides a wealth of information on ink striation analysis and how he used it in the examination of medical treatment records.

The well received new section on Authorities Speak Out compiled by Kay Micklitz and Barbara Downer addresses the subject of Proportions in this issue.

The Case Notes section includes interesting cases by Ann Kessler and Shirl Solomon. And as always, Forensically Speaking, by Phyllis Cook completes this issue.

Barbara Downer, Editor

Editor's Note: As you may have noticed, this issue is Volume 27. If you are keeping your issues of the Journal together, it may appear that Volume 26 is missing. However, the Spring 2003 Volume was inadvertently numbered Volume 25 which was the same Volume number as the previous issue. The Editorial staff regrets any confusion this may have caused.

DISGUISE THROUGH OTHER-HAND WRITING

by

Willa W. Smith, ED.D., CG, CDE

**"Assumed illiteracy is a frequent disguise." –
Albert Osborn**

This article describes an empirical study of dominant-hand versus non-dominant-hand printing, using subjects from an anonymous-letters case.

Anonymous letters can cause the receiver, at the least, emotional distress, jealousy or suspicion. They also may contain malicious libel, blackmail, and even threats of future harm. Writers of this type of persecution will disguise their writing, trying to prevent identification by masking their natural habits.

Bruno Richard Hauptmann, the kidnapper of the Lindbergh infant in 1935, disguised his ransom notes by reducing the quality of his writing, to conceal his identity and give an impression of having less intelligence and education than he possessed. (Figure 1) After his conviction, he was quoted in a New York paper as saying, "Dot handwriting is the worst thing against me."

Willful deception in handwriting, going against one's natural characteristics, results in an inferior product, often clumsy, inconsistent and irregular; in other words, less literate.

What could be easier, when one wants to assume illiteracy, than writing with one's non-dominant hand? As part of an anonymous-letters case,

where it was suspected that at least some of the notes were printed with the non-dominant hand, 32 company employees were asked to print a fabricated text containing many letters, letter-combinations, and words found in the questioned documents. The subjects copied the printed sample three times with their dominant hand and three times with their non-dominant hand. The employees were not told they were suspects, and all but one (the perpetrator) did not know the real reason they were asked to participate. However, they could not be identified or questioned, putting some limitations on the study.

Less than half of them (12) were able to produce legible, fairly controlled writing in the other-hand examples. Those subjects generally kept their natural spatial aspects. The other 20 subjects assumed less consistent spacing and horizontal arrangement (most tended downhill), and had more of a problem with legibility. Nearly one-third of the subjects showed some improvement during their non-dominant attempts, but with most, what was difficult remained so.

All but one subject wrote larger with the non-dominant hand. All had difficulties with stroke direction (Figure 2), producing squared, angular, or even jagged strokes where curves normally occur. (Figure 3) At best, the other-hand printing was childlike and less coordinated. (Figure 4) Tremor was apparent in those examples where the letters were slowly and carefully executed. (Figure 5)

Most subjects maintained their natural upright slant when changing hands. Eight subjects had a natural slant to the right and all of them changed to a more upright slant when printing with the

non-dominant hand. Only one subject had a natural left slant, which changed to the right. (Figure 6)

Limitations to this study included the fact that the subjects were all employees of the same company and suspects in an anonymous-letters case. Since they could not be identified or interviewed, there was no way to determine or control for gender or handedness. The changes produced were a result only of the change of hands, and most probably not of any intent to alter or disguise letter strokes or formations. All subjects kept many of their natural writing habits when printing with the non-dominant hand, even though they were regressing to perhaps six years old or younger in their fine motor capacities.

A sharp eye will be able to match the writings on the next page.

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Willa W. Smith, Ed.D., CG, CDE, has been examining handwriting for more than 26 years. A former teacher, she has had her own business in Tampa, Florida for 14 years. She does personality evaluations for business and private clients, and examines documents for the courts, as well as teaching, speaking and writing about handwriting matters. She is on the editorial boards of AHAF and NADE.

1	to marry me.	TO MARRY ME.	A
2	To MARRY ME.	to marry me.	B
3	to marry me.	to MARRY ME.	C
4	to marry me.	TO MARRY ME.	D
5	TO MARRY ME.	to marry me.	E
6	TO MARRY ME.	to MARRY ME.	F
7	to marry me.	to marry me.	G
8	to MARRY me.	to marry me.	H

Can you match these dominant hand writings (left column) with the non-dominant hand writings? Answers are listed at the end of the illustrations, on page 7.

Dear Sir!

Have 50.000 \$ ready, 25.000 \$ in
20 \$ bills, 15.000 \$ in 10 \$ bills, and
10.000 \$ in 5 \$ bills. After 2-4 days
we will inform you with a delivery
the money.

We want you for making
anything public or for notify the
the child is in your care.

Instructions for the letter are
signature

and 3 holes.



Figure 1: The first note in the Lindbergh kidnapping case.

Rodell's,
Rodell's

Figure 2

marry
marry

Figure 3

Dear Greg,
Dear Greg,

Figure 4

Really the ring
Really the ring

Figure 5

sending it back
sending it back

Figure 6

Answers to exercise: 1-B, 2-D, 3-H, 4-G, 5-A, 6-C, 7-F, 8-E

PARKINSON'S DISEASE AND HANDWRITING

by

Kay Micklitz, CDE

This paper is a summary of a review of various articles regarding Parkinson's disease and its effect on the motor skills and handwriting of individuals suffering from the disease. The purpose of this article is to provide some insight into what is revealed when examining the handwriting of an individual diagnosed with Parkinson's disease. This author was not a participant in any of the research and test results published.

The onset of Parkinson's disease can occur at any age, to any gender, at any time, and in many different ways, although it most commonly occurs in middle age and the elderly. Parkinson's disease is just one of many diseases affecting about 10% of the elderly; however, Alzheimer's disease is several times more prevalent. Both of these conditions affect the ability to write. This presentation will deal only with the effects of Parkinson's disease on handwriting.

Extensive research on Parkinson's disease and its effect on handwriting has been performed, and there are many publications detailing the results of these studies. The purpose of this presentation is to outline briefly some of those effects that can be seen in the handwriting and to help the document examiner understand and identify what one is observing when examining a questioned writing or signature from an individual suffering the effects of Parkinson's disease.

Three primary signs of Parkinson's disease are rigidity, slowness of movement (bradykinesia) and tremor (Willard #2; Anderson #3; Gilbertson #8; Robertson #16; and Matley #17). Gait is also affected by Parkinson's disease, but this paper deals with handwriting and does not address the effects of Parkinson's disease on gait. All of these symptoms manifest themselves in the writing of an individual affected with Parkinson's, some more than others.

Medication specifically administered for Parkinson's disease will affect the person's ability to write. Whether or not the individual was on medication must be considered when examining the handwriting.

In examination, one first should consider the size of writing. Typically, micrographia (uncontrollable diminution in the handwriting) is characteristic of Parkinson's disease; however, it is important to also keep in mind that vision changes can affect the size of the writing which may be measurably larger writing when done without glasses than while wearing glasses.

Also, the handwriting without benefit of proper medication tends to get smaller. Writing and signatures in the early stages of micrographia reveal well-formed letters with amazing clarity when examined through a microscope. As the disease causes continued deterioration, the handwriting progressively gets smaller and it becomes difficult to see the details of the writing without the use of a microscope. Research results (Anderson #3 and Freund #11) also noted that the general letterforms were not significantly altered, nor was word spacing or baseline compliance. It is believed that the writing size reduction might be related to motor

processing demands. Micrographia, commonly associated with Parkinson's disease, can also be found in other medical conditions.

Although stroke size did not show a significant effect as a result of the slowness in the writing, there is a significant effect of pattern and overall size. The writing of patients with Parkinson disease will be smaller in complex patterns such as "lililili" than in less complex patterns such as "lllllllll".

Telescoping, where the writing steadily decreases in size as it continues, is an aspect of micrographia. It may range from the beginning of a line to the end of a line or from the beginning of a passage to the end. Telescoping can occur from the beginning of the name to the completion of the name or for the entire signature.

Stress also affects the handwriting of patients with Parkinson's disease. The stress tremor of Parkinson's disease has the appearance of small, wavy squiggles. This stress tremor can be differentiated from the tremor of forgery, particularly when viewed through a stereoscopic microscope. Photographic enlargements can be used to illustrate this. (Bain #10, illustrations at pp 10-19)

A frequent example of tests given to patients with Parkinson's disease involves the drawing of spirals. The end result has been that the patient with Parkinson's disease will produce wobbly curves when drawing a spiral. The greater the progression or the severity of the disease, the greater the tremor (lack of motor control) that can be seen in the spirals. Larger circles are more easily drawn than smaller circles and exhibit a greater variability in the circle size

overall. Larger circles also were drawn faster than smaller circles. (Freund #11) Wobbly curves can be seen in the writing, particularly when examined microscopically, as many of the letters of the alphabet have circular or spiral movement patterns. It can also affect the connective strokes between the letters. Thus Parkinson's patients are less able to produce smooth and accurate movements with their writing. The more writing that is required, the more it will increasingly deteriorate due to difficulty in pen control.

Rigidity makes it very difficult for the writer to initiate a movement and then sustain the movement once writing is begun. Thus, the writing results in smaller movements due to the increased muscle activation required.

Bradykinesia is the slowness of movement and it is the most disabling symptom of Parkinson's disease. The slowness of movement also tends to reduce the overall size of the writing.

Tremor is a result of a lack of motor control. Tremor has been described as "a rhythmical oscillatory movement of a body part." (Walton #1 and Bain #10) Tremor is more obvious in drawings of spirals than in handwriting. Parkinson's disease is distinguished by a tremor that is worse in the resting state. When the patients with Parkinson's disease form the intent to do writing, they can overcome the tremor, at least to some extent, by doing the writing activity. In handwriting, this means the tremor may appear at the place where they put pen to paper, then become less noticeable or disappear as the writing continues. When the pen is lifted, tremor starts again and will become less noticeable or disappear as the writing is commenced and continues.

Tremor is also better or worse according to medication administered and the levels of medication. Tremor is also aggravated by stress, emotional, excitement, fatigue, etc.

All tremor greatly reduces the relative tempo of the writing and all tremorous writing is slow writing. Tremor is narrowly defined as periodical deviation in the intended direction of the stroke. (Walton #1) Handwriting examined under magnification or microscopically will show the interruption of stroke movement in the expected pattern of the letters.

A person's mental condition will have a very decisive influence on the character of his writing. Consideration must be given to the deterioration evidenced in the writing, as there may well be evidence of deterioration in the mental faculties of the individual. J. Newton Baker, *Law of Disputed and Forged Documents*, at p. 345, states that the character of the writing may be affected by the physical conditions that disturb the mental condition at the moment of writing. The ravages of the disease may have impaired the person's mental faculties to the extent that he cannot exercise complete muscular control. There are exceptions, however, and the greatly impaired physical condition of the writer will naturally lower the quality of writing even though the mind is clear and fully comprehends the seriousness of action, especially that of affixing a signature to an important document.

For the document examiner to recognize what he/she is observing in writing, it is important to note how these elements are evidenced in the writing. It is reasonable for the researcher to read and understand the results of the tests that have been completed and published. However, reading words that are the results of

the tests, understanding the impact of what has been read and, then being able to identify visually in the writing specimen how these elements are presented sometimes can be difficult.

Indicators of writing possibly influenced by Parkinson's disease are listed below. Some, but not all, of the indicators are expected to be found in the handwriting.

- Writing that is worse to begin with and is better as the writing progresses.
- Writing that is better to begin with and gets worse as it goes along.
- A small fast tremor versus a large coarse one.
- The writing is even or erratic in its oscillations.
- A jerkiness, or hesitation, followed by a sudden movement.
- Tapered beginnings and conclusions.
- On-off pressure; pen pressure that is heavier (thicker) in downstrokes alternating with lighter (thinner) upstrokes.
- Pen lifts seen within words. Pen lifts most often occur after completion of a character, and in some instances lifts separate *parts of a character*.
- Dots and dashes in irrelevant places.
- A mixture of curved and angular strokes.
- Irregularities in rhythm involving inconsistent slope and/or character size.
- Slurring of characters, such as flattened parts that are normally curved.
- Omitted parts of a character.
- Variability in character formation.
- More than one character formed with different numbers of strokes.
- Word alignment in sentences.

- Alternating bursts of pen pressure and writing speed.
- Frequent pen lifts; pen drags.
- Letter forms progressively shorter and narrower, while spacing stays proportionally the same.
- Slow writing with pauses where stroke direction changes causing the appearance of ink spots and muddiness.
- Small letters that run together causing threading when micrographia is extreme.
- Moments of rest (mind pauses).
- Inferior quality of writing, broken lines, misspelled words, or blotching of the paper with ink (signs of impaired mental faculties).
- A lack of smoothness, elasticity, fluidity and/or a lack of proportion.
- Cramped writing forms and awkward connecting strokes.
- Restrained spontaneity.
- Cramped horizontal expansion.
- Pinched writing.
- Irregularities on rounded strokes.
- Retouching on t-bars, i-dots, and endings.
- Other areas of placement of a period after a signature (not in known writing).
- Writing that is clearer, slower and more precise, including diacritics, with less feathering.
- Interruptions not only between letters, but also within the body of a letter itself.
- A missed letter (indicative of stress and confusion).

It should be noted that one or more handwriting characteristics of Parkinson's disease might not be present in a particular patient with Parkinson's disease. Therefore, handwriting may be indicative of Parkinson's but cannot be diagnostic in confirming it. Nor can absence of

one or more of the traits listed above be taken as proof that the writer is without Parkinson's disease.

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**LEFT-HAND AND OPPOSITE-HAND
WRITING FEATURES
USEFUL AS A BASIS OF FORMING
EXPERT OPINIONS OF AUTHORSHIP**

by

Jacqueline A. Joseph, CDE

Abstract:

When comparing handwritten documents concerning disputed authorship, the examiner is responsible for applying a reasonable explanation to an observed significant difference between features as part of the forming of an expert opinion of identification. This article discusses the features attributed to the use of the left hand and the opposite- or non-dominant hand..*

** A significant difference is defined as an observed unique feature variation that is not observed in the writer's habitual pattern in the known writing being examined, and not attributed to an accidental cause.*

In an investigation involving questioned authorship, most handwriting comparisons concern the matter of whether or not the questioned and the known handwriting were written by the same person rather than the question of which hand was used.

Many factors are involved in a comprehensive examination and comparison of writing and of the formation of an expert opinion including:

1. the extent that the subject's handwriting is modified;

2. the skill and competence of the examiner;
3. the nature of the questioned document and the available material for comparison.

In forming an expert opinion regarding authorship, the subject writer's use of the unaccustomed hand for writing, whether ambidextrous or not, is considered as a reasonable explanation for significant differences between comparable features (Alford, Edwin F., Jr., "Disguised handwriting: A statistical survey of how handwriting is most frequently disguised." *Journal of Forensic Sciences*, 15:476-88, Oct 1970). The significant differences, along with the appropriate reasonable explanation, can be clearly demonstrated to the fact finder and supported by research, as reported herein and elsewhere.

Adult writers are generally more proficient with one hand than with the other. According to F.E. Dreifuss, in his article "Diagnosis and treatment of incomplete cerebral dominance" (*Journal of the American Medical Association/JAMA*, 206: 141, 1968), the ratio of right- to left-handed individuals is 7:1. A child will usually be either right- or left-handed by 18 months of age. The hand used commonly for manual tasks may or may not be the hand preferred for writing.

In forming an expert opinion of common authorship, the examiner considers whether or not a questioned writing is the product of a naturally, or circumstantially left-handed writer, or an attempt by a subject writer to conceal his/her identity by using the non-dominant left hand. Opposite-hand writing as discussed by Viola Stevens is based on her research of over 4000 specimens of handwriting. (Stevens, Viola.

“Characteristics of 200 awkward-hand signatures.” *International Criminal Police Review*, 237:130-7, April 1970). From an examination of pairs of specimens of two-handed writers, it was found that, in every pair, one specimen was vastly superior to the other in quality. Furthermore, she found that both right-hand and left-hand writers changed to vertical slant when using the opposite hand.

In his study of American and Israeli left- and right-handed writers, Benny Shanon reports that the features in the handwriting of foreign scripts, such as Hebrew or Chinese which are written either from right to left or vertically, are observed as features similar to the left-hand writer and the ambidextrous (Shanon, Benny. *Graphological patterns as a function of handedness and culture. Neuropsychologia*. 17:457-65, 1979).

Dawson reports, in his study comparing right-hand writers writing with their left hand, that the primary difference between the writings was observed in the writer's skill of execution; whereas, the spacing between letters, words, and lines remained proportionally the same. (Dawson, Greg A. *Brain function and writing with the unaccustomed left hand. Journal of Forensic Sciences*. 30:167-71, Jan. 1985).

The following lists of traits having significance indicating a person is writing naturally with his or her left hand, or a right-hand writer writing with the unaccustomed left hand, are composites of traits resulting from research reported in the articles annotated and listed in “The Annotated Bibliography: Left-Hand and Opposite-Hand Writing Features Useful as a Basis of Forming Expert Opinions of Authorship” compiled by Jacqueline A. Joseph.

(National Association of Document Examiners Journal. Vol. 27, Number 1, Fall 2004)

Traits having significance indicating a person is a left-handed writer:

- Crossing of the lower case t from right to left.
- Leftward drag of elongated i-dots.
- Long initial stroke of letters at the beginning of a word which may proceed either in an upward or downward direction.
- Hooks and curves at the beginning of some small and capital letters which commence in a leftward direction.
- Prominent eyelets in beginning part of the small a, d and g, representing an initial underhand motion.
- Overhand motion in forming lower case v (made with retrace or eyelet at bottom) and the lower case h (eyelet formed where loop and hump are joined).
- Tenting of lower case h, l, and t; and tenting of the upper part of capital i and j.
- Open lower part of the final lower case g and y with the ending stroke curving to the left; also triangular or v-shaped lower parts of those letters.
- Absence of terminal endings of such letters as lower case d, l, and t, as well as lower case h, m, and n, with slight pen drags to the left.
- The terminal of the lower case s with an absence of a retraced bottom coupled with a leftward extension of the closing part.
- Similar to the lower case s, the lower case f and k, as well as capital G, also are found to have considerable leftward extension in their closings.

Traits having significance indicating a person is writing with his or her opposite hand:

- Upright slant.
- The t crossings may be crooked and wandering.
- The flat top r (See Figure 1).



Figure 1: The flat top r

- The flat top rather than rounded upper loops.
- The d and t may be unlooped or tent-shaped with wide bottoms (See Figure 2).



Figure 2: The tent-shaped t

- Acute angles in connecting strokes.
- The g, j, and y have flattened bottom loops.
- Dragging terminal strokes.
- Low level of skill of execution and uncertain movements (See Figure 3).

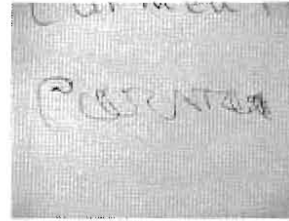


Figure 3: Uncertain movements

- Fine tremor and lack of smoothness in line quality. (See Figure 4)



Figure 4: Fine tremor

- Abrupt directional changes. (See Figure 5)



Figure 5: Abrupt changes in direction

The examiner considers that questioned handwriting having an unnatural appearance may or may not have been written by someone using the left hand, or the unaccustomed opposite hand. Some features of opposite-hand writing are also observed in the writing of the ordinarily unskilled writer. Furthermore, contrary to some views that left-handed writers are less skillful than right-handed writers, in his study Gordon Stangohr reported no remarkable

skill difference between the two groups (Stangohr, Gordon R. "Opposite-hand writings." *Journal of Forensic Sciences*. 13:376-89, July 1968.). This justifies the need to do a thorough, comprehensive and exhaustive investigation comparing all available information and exemplars (especially the opposite-hand requested exemplar, if possible).

Jacqueline A. Joseph, B.A., CDE is a proficiency-tested, board certified document examiner, and member of NADE currently serving as Certification Committee Chairman. As a practicing handwriting investigator since 1992, she is the owner of Accurate Document Examiners, a forensic science laboratory in Portland, Oregon. She compiled "Genuine Tremor in Handwriting vs. The Tremor of Fraud: An Annotated Bibliography as It Relates to Questioned Document Examination." Her published papers include "Identifying the Maker of Handwritten Numbers," "The Unidentifiable Handwriting – An Anonymous Note Case," and others. She has lectured at Portland State University and for various professional groups and has given expert witness testimony in court, arbitrations and depositions. www.jjhandwriting.com

ANNOTATED BIBLIOGRAPHY

Left-Hand and Opposite-Hand Writing Features Useful as a Basis of Forming Expert Opinions of Authorship

Compiled by

Jacqueline A. Joseph, CDE (February 2004)

Compiler's Comments.

Although the total compiled here includes numerous articles, it cannot be claimed that this bibliography is complete. This is a selected bibliography. Other areas of consideration regarding this topic require further pursuit.

Many of the works listed have extensive bibliographies to which the reader's attention is also specifically directed.

Not all entries have annotations, but the absence of an annotation should not be an implication that the work has less value than annotated entries.

The author's biographic footnote is contemporaneous to the date of publication.

Most citations were drawn from "The QDE Index" and "Health and Handwriting: An Annotated Bibliography of Forensic, Legal and Med/Psych Periodical Literature." Both works are by Marcel B. Matley of A & M Matley Handwriting Experts of California.

Jan Tudor of JT Research and Marcel B. Matley of A&M Handwriting Experts served as research assistants. They searched the UCSF Medical Library and other academic libraries.

This work was supported by a research grant from the Natural Sciences and Engineering Research Council of Canada. The paper summarizes what was found to characterize handedness in the areas of writing speed, legibility, character shapes, and formation. The results were based on several experiments conducted by the author and the research team at Concordia University and included a small group of left-handers and a small group of right-handers. Comparatively, the most significant differences were found between writing styles (printing to cursive) within each group. For both groups, it was found that cursive, as compared to printing, measured the fastest writing style, notably due to the number of pen-lifts used when printing versus writing in cursive. The experiments also indicated that right-handers were about 10% better letter recognizers than left-handers. Finding the reasons for this, the authors contend a way to correlate writing habits with the neurological organization of the human brain for languages. Includes bibliography, charts and tables of statistics.

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Handwriting generation, perception and recognition. Suen, C.Y. Department of Computer Science, Concordia University, Montreal, Quebec, Canada.

2. Canadian Society of Forensic Science Journal. 26:61-7, 1993.

An identification of handprinting produced with the unaccustomed left hand. Dawson, Greg A.

3. **Criminal Law Review (London).** 1962:750-69, November 1962.
Disguised hand. Harrison, Wilson R.

4. **Journal of The Forensic Science Society.** 22:271-4, 1982.

Direction of ballpoint pen strokes in left- and right-handed writers as indicated by the orientation of burr striations. Franks, J.E. Department of English Language and Literature, The University of Birmingham, England.

A discussion of burr striations as a result of the use of ballpoint pens relative to the direction of movement, most notably in the curved strokes, is comprehensive. One illustration.

5. **Ibid.** 23:237-40, 1983.

Dependence of slope of handwriting upon sex and handedness of the writer. Totty, R.N., and R. A. Hardcastle of the Forensic Science Laboratory England, and Jane Dempsey, of the Department of Mathematics, Lanchester Polytechnic, England.

This article discusses the limited findings from 200 subject writers that right-hand writers wrote with a greater forward slope than left-handed writers.

6. **Ibid.** 25:353-70, 1985.

Variability of stroke direction between left- and right-handed writers. J. Franks and T. Davis, Department of English Language and Literature, University of Birmingham, UK., R.N. Totty and R.A. Hardcastle, Forensic Science Laboratory, Birmingham, UK., and D.M. Grove, Department of Statistics, University of Birmingham, UK.

This article illustrates the research methods and results of research with thousands of writers. As an indication of handedness, their research shows that the significant differences between left- and right-handed writers in the direction of pen movement is more reliable in straight lines, such as the crossing of the horizontal bar in capital letters A, H and T than with clockwise strokes in circle letters. Their paper was presented, in part, to the American Society of Questioned Document Examiners 1983 meeting.

7. **Ibid.** 25:371-5, 1985.

Study of the form and extent of natural variation in genuine writings with age. Kapoor, T.S., M. Kapoor, and G.P. Sharma. Police Forensic Science Laboratory, India.

This article discusses the three stages of the development of handwriting characteristics: pre-mature, mature and deformative. The conclusion of the authors after researching 50 persons, over a period of ten years, justifies the necessity for contemporary writings in comparison of handwriting. It also indicates that the master patterns, in mature writers, remain unchanged. Limited bibliography. Chart of findings and one illustration showing an extreme case of variation of one writer over a period of ten years.

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Disguised handwriting. Konstantinidis, Siv.

9. **ID NEWS.** 30:5-7, August 1980.

The problem of left- or right-handedness almost solved. Hale, James L.

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Characteristics of 200 awkward-hand signatures. Stevens, Viola. Document Examiner, Crime Laboratory Division, Wisconsin Department of Justice.

An excellent paper detailing the author's research project including a review of the literature and clear illustrations of results of studying signatures of inmates serving sentences on charges of forgery, including volunteered samples of the inmates' signatures written with the right hand and also written with the left hand totaling over 4000 specimens from over 200 inmates. The author includes research from the medical literature discussing the physiological and neurological factors which may produce handedness in an individual. Her research led to answers about the percentage of a given population that normally uses the left hand for writing (9%), how frequently ambidexterity in handwriting is encountered (rarely), and how opposite-hand writing differs from preferred-hand writing (flat top r, d, l and other looped letters, vertical slant dominates, fine or bizarre tremor, open base t and d, wandering t bar crossing, dragging terminal strokes, abrupt changes in direction, comparatively low level of skill of execution). The author also answers the question of whether or not awkward-hand writing can be identified as to its source with the advice that the observed significant differences be carefully evaluated in terms of all

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Empirical study I: Effects of writer's position and document placement on signature writing. (Pages 5-20.) *Empirical study II: Effects of writer's position and document placement on signature writing when subject is assisted, guided, or controlled by another party.* (Pages 21-62). *Empirical study III: Effects of assisted, guided, and controlled-hand writing conditions on subject and assisting/guiding/controlling party.* (Pages 63-94.) Briggs, Marion E. and Joan Christo-Bruner, Glenda C. Portman and Lynne Variano.

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Empirical study: Writer identification. Part I: Determination of gender and writing hand from handwriting. Part II: Comparison of male and female penmanship characteristics. Part III: Examination of left-handed handwriting characteristics. Briggs, Marion E. and Glenda C. Portman.

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Includes a good photo of the up-side-down left-handed pen hold and explains the observations of the resulting i dot which, when the writer writes with speed, is shaped like a bowl or slanted vertically, which also may be observed in the period, colon and other similar

punctuation marks. The tapering of the t bar on the left of the stroke indicates the writer moved from right to left to cross the t. The t would also have a wavy or slanted bar crossing indicating the left-handed writer used finger movement alone with the base of the hand remaining immovable. This creates an additional problem not experienced by the right-hander, whose hand is free to move forward, like a pivot, during the crossing of the t from left to right. The author comments about a smudge pattern which may occur when the left-hand writer's hand frequently moves across previously written lines during the writing. As the hand moves downward to the next line of writing, ink impressions are transferred from the base of the hand onto the paper.

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Graphological patterns as a function of handedness and culture. Shanon, Benny. Department of Psychology, The Hebrew University of Jerusalem, Israel.

The author studied American and Israeli left- and right-handers as they drew horizontal character elements, lines and faces. Comparing biological and environmental factors of both groups,

because Americans write and scan from left to right, whereas Israelis scan and write from right to left, resulted in data supporting an interactive model stipulating that: (a) the natural directionalities associated with right and left handers are different: left-to-right and right-to-left respectively, (b) the culturally induced directionalities associated with English and Hebrew writing are different: left-to-right and right-to-left, respectively, and (c) moreover, the behavior exhibited by right-handers is fully determined by the natural, biological tendencies/genetics, whereas left-handers are susceptible to environmental influence.

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A study of two cases of unaccustomed handwriting. Singh, Amar and S.N. Gupta, Central Forensic Institutes, Bureau of Police Research and Development, India.

This article illustrates comparative features, in two cases, of the normal writing and unaccustomed hand writing of one person on one document. Authors discuss the indications of common authorship concluding that the body of the writings was written with the normal hand, and the endorsements on the documents were written with the unaccustomed hand. Illustrations are in Hindi, therefore not easy to discern. Includes bibliography.

Jacqueline A. Joseph, B.A., CDE is a proficiency tested, board certified document examiner, and member and Certification Chairman of NADE. As a practicing handwriting investigator since 1992, she is the owner of Accurate Document Examiners in Portland, Oregon. She compiled "Genuine Tremor in Handwriting vs. The Tremor of Fraud: An Annotated Bibliography as It Relates to Questioned Document Examination." Her published papers include "Identifying the Maker of Handwritten Numbers," "The Unidentifiable Handwriting – An Anonymous Note Case," and others. She has lectured at Portland State University and various professional groups and has given expert witness testimony in court, arbitrations and depositions. www.jjhandwriting.com

**INK STRIATION ANALYSIS
OF BALL-POINT PEN WRITINGS
and
Medical Treatment Records**

by
John F. Cerlanek, CDE

ABSTRACT

Ink line striations, commonly found in ball point pen writings, are very useful and effective in the analysis of many types of questioned document cases.

This article addresses the forensic and objective evidence provided by the characteristics and analysis of ball point pen ink striations and presents several questioned document cases as examples. The Medical Treatment Record is the primary application of focus, and a more comprehensive discussion is included on these suspect documents.

Some of the questioned document topics include: ink and pen discrimination; pen identification; authorship determination; medical claims fraud; authentication and detection of fabrication of medical treatment records; habitual rhythm patterns; and the use of mathematical probabilities in evaluation of ink striation evidence.

INTRODUCTION

There is very little (to no) difference in the manufacturing precision between the cheapest and the most expensive ball point pen.

The making of any ball point pen involves very high precision manufacturing processes and extensive quality control measures. The

production yields are amazingly high and defects are amazingly low. The lowest cost pens typically produce just as flawless ink lines as the more expensive models. The average shelf life is advertised to be two years, but my studies indicate it is at least two times that period of time, and they have long ink life. No wonder, after approximately 60 years of commercial use in the United States, they still remain so popular. However, they do have one flaw. Shortly after being put into use, "striations" start to appear in the ball-point pen ink line. The pen manufacturer regards this phenomenon as a somewhat troubling imperfection, but from a forensic point of view, ink line striations are a major benefit to the science of document examination.

**OVERVIEW OF
INK STRIATION ANALYSIS**

Knowledge of the characteristics of ball point pen writings and ink striation patterns, combined with proper questioned document examination logic and objectivity, lead to the understanding of how and when to apply and use ink striation evidence.

As with the application of any legitimate scientific analysis, proper procedures and equipment must be utilized. Depending on the questioned document problem, the applicable striation analysis procedure and equipment can be simple or somewhat sophisticated. The simple analysis procedure can involve a quick observation or visual examination of a striation pattern, using a hand held magnifier, with no measurements required. The sophisticated analysis procedure can involve a tedious and time-consuming process of measuring and/or comparing many striation patterns, utilizing precise scientific methods and equipment.

Note

The ball point pen ink striations discussed in this article, refer to the long time "standard" type ball point pen, which contains a high viscosity, pasty ink. The newer "rolling writer" or "gel" type ball point pens, contain lower viscosity, more fluid inks, which very rarely (or never) exhibit these type of striations. References to "ink line striations", "ink striations", "burr striations", "micro-striations" or "striations" are intended to mean: "ball point pen ink line striations". Similarly, the reference to a "pen" is intended to mean: "ball point pen."

INK STRIATION CHARACTERISTICS

► ***Ball point pen ink striations often look like scratches or lines, which run longitudinally within straight sections of the ink line and enter or exit the ink line in semi circular strokes.***

These scratches or lines (striations) are actually segments of the width of the ink line, which are void (or depleted) of ink deposition.

► ***Ball point pen ink striations are caused by obstructions, which prevent or restrict the transfer of ink onto the exposed writing surface of the rolling ball.***

Three primary sources of ink flow obstructions, which cause striations, are:

- (1.) lint, paper fibers, sealers, fillers, and dust and debris which become wedged in the tiny opening between the pen tip ball housing rim and the ball. This debris is picked up from the surface of the paper by the rolling ball.
- (2.) particles of crystallized ink dyes, or dried ink which become wedged in the tiny opening between the pen tip ball housing rim and the ball (with debris);
- (3.) deformations, dents, burrs or machining

defects, of (or on) the pen tip ball housing rim or the inside walls (which is usually brass, a soft metal).

See FIGURE 1 - "Magnified Ball Point Pen Tip Study"

► ***Ink line striations are unique in configuration and can identify a specific pen.***

I believe "rifling on a bullet" is a close analogy to "ink striation patterns" deposited by a ball point pen. The bullet is "striated" on its circumference by the rifling in the gun barrel. With the ball point pen, the ink line is "striated" by the obstructions (or debris) at the ball housing rim. A well-defined ink striation pattern with multiple striation lines, of different widths and spacing, can be extremely unique to a specific pen. The preceding analogy does not typically apply as well, to the frequency or stability of ink striations, however. Ink striations deposited on paper are not as universally stable as the metal to metal rifling striations, on a bullet. For example: new ball point pens typically exhibit no ink striation patterns; and some pens deposit ink lines, which do not adequately exhibit the existing striation patterns (due to the covering of ink flow or vague definition).

► ***The dynamics of ink flow can and do affect the ability to thoroughly view and accurately define a striation pattern.***

A striation pattern can appear and/or disappear, in part or total, due to varying ink flow characteristics and deposition. These unstable striation patterns are not typically changing; they are just being obscured or hidden by the varying density or covering of ink.

Characteristically, the temperature of the ink is a primary variable, which affects ink flow and

deposition. At higher (relative) temperatures, the ink becomes more fluid and produces a heavier deposition. The “cold pen start”, is an example of this temperature phenomenon. How many times have you picked up a pen that hasn’t been used for a while and had to scribble with it before it started to write? This is a cold pen. What you have done by performing this scribbling is agitate and heat the ink at the pen tip. The pressure and friction on/of the rolling ball increases the temperature and fluidity of the ink, and the pen begins to write. Remember, the standard ball point pen ink is pasty, with a consistency close to that of honey. The sparse ink deposition at the start of the initial writing line of a ball point pen that has been dormant for some time, is almost always a result of this cold start phenomenon. A cold pen start can be exhibited by some pens, after as little as 45 seconds of non-use. Of course, there are many other variables which can affect ink flow and deposition (i.e. writing pressures, moisture or heavy humidity, aging or deterioration of the ink, paper qualities, starvation, etc.).

► ***Striation patterns are dynamic and can change over time.***

The configuration or quantity of ink flow obstructions, which cause the striations, can change with usage due to: heavy writing pressures; writing papers or materials used; handling abuses and drops; ink oxidation or crystallization of the dyes; excessive exposures to heat, cold and humidity, etc. etc.

Although it is true that, over time, ink striation patterns can and do change, it has been my experience that changing patterns are rare, and hard to find in writings. The problem of changing or vague visibility is extremely more common. Changing patterns are probably less commonly seen, due to the relative small time

span of most questioned documents or writings (as compared to the pens’ life history). I have seen a few changing striation patterns in laboratory studies; however, I can’t recall seeing very many changing patterns during casework. (My guess is probably less than 1% of over 2100 cases worked).

► ***Striation patterns within curved strokes indicate the direction of the pen movement.***

Ink striations move from the inside of the curved line toward the outside of the curved line, in the direction of the pen movement.

Look at the diagram in FIGURE 2 and follow the “A” burr striation. In location 1, the “A” is at the very bottom of the circle (which represents the housing which holds the ball). In the middle of the curved stroke, the “A” striation exits the bottom of the ink line, at position 2.

The article from which this diagram was extracted refers to the obstruction that caused the striations as a “burr”. This is what I refer to as a rim defect (shown in FIGURE 1).

See FIGURE 2 - “Determination of the Direction of Ball Point Pen Motion” by Mr. Ken Snape

► ***Striation patterns track with the position of the pen tip ball housing (and pen body) and therefore their locations in the writing are relative to the position that the pen is being held, in the writer’s hand.***

See FIGURE 3 - “Ink Striation Position Study”

► ***Ink striations can be precisely measured and compared and therefore are objective evidence.*** Objective evidence is scientific evidence that

affords the use of mathematical statistics and probabilities. The "Mathematical Probability Formula for Linking Striations" is presented in the discussion of the Medical Treatment Record in Application #5.

APPLICATIONS OF STRIATION ANALYSIS

As with any forensic evidence, ink striation evidence can and should be supplemental to other findings and techniques of analysis.

Following are a few examples of applications and uses of ink striation analysis involving typical questioned document cases.

I. Identifying the direction of pen movement in writings.

Ink striations are useful in determining the direction of curved or circular writing strokes. Do you remember how the striation pattern indicates the direction? The striations in curved strokes travel from the inside of the ink line, to (or toward) the outside of the line, in the direction of the stroke. So if you have a curved or circular stroke, the direction of the pen movement is indicated by the striations.

Application #1. Authorship Determination

Identifying or disqualifying the writer of a questioned document by using Ink Striation Examination

Suppose you are asked to identify (or disqualify) the writer of a questioned note or document. In your ink striation "examination" of the curved strokes in the questioned writings, you find that all the O's, (or B's, or C's, or 8's, or 6's, etc.), are formed in a clockwise direction and in all the

exemplars they are formed in a counter clockwise direction.

In this case, you probably would have supplemental evidence to add to your other findings. However, remember, this is not just subjective evidence. This is objective evidence! There is no question the striations indicate two different movements. The lines just have to be curved enough to see the striation movement. The proper equipment and procedure, in this example, are simple: A handheld magnifier and a visual examination are all you require.

II. Ink and Pen Discrimination

Application #2. Relative Ink Discrimination

Determining whether two writings were performed with the same pen, when the two writings contain a distinct and prominent difference in striation patterns.

Suppose you are asked to determine if a written entry on a single page document was entered in the same sitting as the other writings on the document, and with the same pen. The document is a printed form with a printed date and six lines on the form contain hand writings.

In this case the form was supposedly completed and signed by one person and then signed by the other person present. The suspicion was that the person who completed the form made another entry on the form, when the second party left the room. It was reported that this additional unnoticed entry, would have been made within ten minutes of the initial completion and signing, of the document.

Assume: the writer of the form entries did write in the additional entry, with another pen – however, and here’s the kicker: “this second pen came from the same box (of six ball point pens) as the first pen”. Imagine how extremely similar the relative ink examinations of color, line width, UV, IR and TLC would all turn out. However, under examination you find that the questioned writing contains a pronounced and consistent striation, which appears in the same position in all the down strokes - and in all the other entries, before and after the suspect entry, the writings contain no striations at all.

The fact that the questioned entry was the only writing with striations (in this case) indicated a strong probability that a second pen was used, to make this questioned entry. I had a case, very similar to this example. The required equipment and procedure in this example were a simple visual examination and comparison of the two writing ink lines, at low magnification (4X to 8X).

Application #3. Relative Ink Discrimination or Pen Identification

Determining whether two writings were performed with the same pen, when both writings contain similar, complex or numerous striation patterns.

Note, that this example involves the same question as Application #2, except this example refers to striation patterns which are similar, complex or numerous. The reason for this example is to make the point that in this instance proper objectivity requires a more precise comparison analysis. A simple visual examination is not adequate and more precise “ink striation analysis” is required.

The general rules of procedure for proper “ink

striation analysis” (and precise comparisons) will be discussed after the last Application Example, #5.

III. Ink and Pen Identification

Application #4. Identifying a Specific Pen

Identifying a specific pen, which was used to produce writings, by comparing the ink striation patterns produced by the pen with the striation patterns in the writing.

It is possible to identify a pen and the writings it produces by the ink striation patterns, if there is sufficient striation evidence for accurate comparison and discrimination. Comparing the striation patterns of a deposited writing with the striation patterns produced by a specific pen, in an attempt to determine if that specific pen was used (to create those writings), can be a time consuming and tedious task – or just a relatively quick examination process. For example: if the pen produces no striations and the deposited writing is heavily striated (or vice-versa) no further analysis is required, but if the striation patterns are similar, then the process becomes tedious. The procedure for comparing striations of a pen with striations in a deposited writing will be discussed in “General Rules of Ink Striation Analysis”.

The best example of the application of ink striation analysis to identify a specific pen is the 1982 “Blue Brigade Case” prosecuted by the Sherbrook Municipal Police Department in Canada. This criminal case involved five extortion notes and three ballpoint pens.

I found out about this case in January of 1996,

while searching for a criminal trial, in which striation evidence was presented. Upon discovery, I telephoned the listed Questioned Document Examiner, a Mr. Gilles Poulin, with the RCMP Forensic Laboratory in Montreal, Canada and discussed the case with him. We also discussed our mutual research, analysis methods and laboratory equipment.

It is interesting to note that our research conclusions and analysis methods were amazingly similar. He utilized "overlaid macro photographs," which he viewed and compared with binocular and comparison microscopes, in his striation analysis procedure. We were using "overlaid digital images," with a little more sophisticated equipment, in our striation analysis procedure. We captured the striation images through macro photographic lenses and a digital camera system, mounted on a variable height copy stand, with two 21 inch monitors and computer aided software controls. This truly unique and visionary system was designed and built by Mr. Bob Campbell, in 1992. Bob was the VP of R&D for our Questioned Document Lab, which we incorporated as SignaScan Inc., in 1991. Prior to forming this Lab, Bob and I spent three years in research and development of a computer aided signature analysis and verification system.

Mr. Poulin was impressed that we could perform immediate overlay comparisons at variable magnifications up to 200X (with no parallax distortions), as well as capture and process images for evidence exhibits. He mentioned he spent three months working on the Blue Brigade case and over a month in analysis. With our system he could have done the striation comparison analysis in three or four days, with much greater accuracy.

I sent him a detailed description of our computer aided system design and he sent me the paper he wrote and submitted to the CSJS/ASQDE Conference in 1985, regarding his ink striation research and the "Blue Brigade Case". The paper is titled "Ballpoint Pen Striation Patterns As Evidence in Document Examination".

In the first eight and a half pages of Mr. Poulin's paper, he discusses his research findings regarding the ball point pen: precision manufacturing processes and quality control; the causes of striations (the same as listed in this report with more emphasis on the deterioration and aging of blue ink dyes); and some references to the unique qualities of striations. He credits much of the information to engineers at Bic Pen Corporation in Millford, Connecticut.

The following paragraphs are extracted from the last two pages (#9 and #10) of Mr. Poulin's paper, verbatim. They include details of the Blue Brigade Case.

"The pattern of striation is developed at random and the probability of two ballpoint pens producing the same elaborated pattern of striation is extremely low.

The examination consists of matching the various patterns produced by the ballpoint pen with the standards produced by the suspect ball point pen. Four or five good physical matches in different rotation angles may be sufficient to establish with a high degree of probability a direct relation between the standards and the litigious writings.

The Blue Brigade Case

In 1982, the Sherbrooke Municipal Police Department submitted to our R.C.M.P. Forensic

Laboratory in Montreal a series of five extortion notes, with their envelopes, as well as three suspect blue ink ballpoint pens; a Bic Medium, a PaperMate and a Fine Eagle pen.

Physical and chemical comparisons of the ink strokes using Infra-red, I.R. luminescence, width of strokes, and TLC analysis revealed that one ransom note (C-4) and its envelope had the same "class" characteristics as the Bic ballpoint pen (S-1).

Under the binocular microscope, with a medium magnification (25X-35X), the ink strokes of the note showed a very elaborated striation pattern. When viewed using a comparison microscope the striation pattern produced by the suspect ballpoint pen (S-1) matched almost perfectly. These preliminary results were more than sufficient to incite us to investigate the phenomena more closely.

More in depth studies have confirmed our preliminary findings. Additional tests and comparisons conducted with other ballpoint pens have reaffirmed our beliefs to the point that we could positively conclude that the striations observed on the ransom notes had been produced by the Bic ballpoint pen quoted S-1. Our testimony identifying the Bic ballpoint pen as the writing instrument used to write the ransom note was, to our knowledge, the first of this type being presented and accepted by a criminal court in Canada."

This was the ending paragraph of Mr. Poulin's paper. You can view his trial exhibit, which is shown in: Figure 4 - "Striation Caractéristique Du Bic S-1".

This is the only reference of a criminal case in

which striation evidence was presented, that I was able to find. I have presented striation evidence in Municipal and Superior Courts, and have provided approximately 760 Medical Claim Case Reports (with findings of fabricated treatment records, indicating fraud) to Insurance Company SIU's, but have not been called to testify in any criminal cases.

Thirteen of these Case Reports were provided to the FBI in one criminal case against a Doctor, in northern California. I worked these thirteen cases for four different Insurance Companies, over a period of three or four years. These cases involved three different Medical Clinics, in northern California. A few years ago (around the year 1998) I was sent a list of these cases with a request to forward copies of my reports. After I assembled the reports, I was amazed to find that all (100%) of these 13 Case Reports indicated fabricated records. I had worked approximately 1900 suspect medical claim cases, at that time, and my average at that time, was approximately 38% (fabricated records). I was told my Case Reports were used as "probable cause evidence", for premise searches and indictments. I have since heard the Doctor was prosecuted and lost his license as well as his three "Fraud Mill" Clinics.

The most conclusive evidence of fabrication, in the 760 suspect medical claim cases, discussed above, was provided by the objective "Ink Striation Evidence" found in the entries on the medical treatment records.

Application #5. Authenticating or Detecting Fabrication on Medical Treatment Records by Identifying the Position a Pen was held to deposit dated Writings –

AUTHENTICATING OR DETECTING FABRICATION ON RECORDS WITH CONSECUTIVE DATED ENTRIES

This procedure is applicable to cases involving Questioned Medical Treatment Records, Maintenance Records, Sweep Sheets; etc.

The fundamental analysis concept in this procedure, involves verification that the time dated entries on these records were entered on the document on separate dates, as the record indicates, and not in multiples - on single dates. The medical "treatment sign-in sheet" is a prime candidate for this type of striation analysis. Finding conclusive evidence that multiples of signatures (and/or dates) were entered on the treatment record on a single office visit (or sitting) indicates fabrication, or a non authentic record. We have coined the term "multiple signing" for this type of fabrication. Multiple signing for medical treatment is by far, the most prevalent type of Insurance Claims Fraud detected on suspect records, submitted to SignaScan's Lab. I estimate that well over 50% of the approximate 2300 suspect treatment records contained this type of fabrication, although, I was only able to find sufficient evidence to prove fabrication on approximately 36% of the first 2100 total cases audited.

The first couple years of operation, we were inundated with suspect medical claims from Insurance Companies and were forced to invest considerable research into this problem. SignaScan's team of scientists, engineers, document examiners, forensic photographers and an ink chemist, put several years into this research effort. Intensive studies and plenty of suspect medical records lead to the development of scientific procedures and specialized

equipment, focused on analysis of the "Treatment Sign-In Sheet". To give you an idea how carried away we got, in one of my first trials involving a suspect medical treatment record, I presented eight categories of evidence: Pens Used (w/UV discrimination); Pen Starts Patterns; Pen Starvation; Ink Density Similarities; Linking Striations; Line of Starts Margin; Signature Rhythm Patterns; and Date Stamp Alignment Patterns. I listed all the findings in a chart that showed the corroborations, between all the evidence. We were opposed by an expert who was the Head of the Long Beach Police Department Questioned Document Lab. The case was "Kim vs. Rose" in 1998. The Jury was convinced the Sign-in sheets were fabricated and awarded the Claimant nothing, plus payment of Court costs. (Attorney Letter and Trials Digest Report on signascan.com under Testimonials)

The most important outcomes of our research were: the effective procedures for analysis of Ink Striations and Habitual Rhythm Patterns; our Computer Aided Document Analysis System; and three U. S. Patents.

The following comprehensive discussions of the Medical Treatment Record will include Case Procedures and other analysis techniques, as well as ink striation analysis procedures.

A procedural caution is warranted, at this point. Before you accept a suspect medical records case, or before analysis is performed, the Client should be made aware that depositions of the people who created the questioned treatment record must, or should be obtained first. For example, if the testimony of the people who created the record was that "the record was transcribed from other records, and all the

entries were entered in a single sitting”, then analysis is not required. Finding evidence of multiple signing in this case would just be a verification of fact.

Testimony that the record was created all at one time, of course, is not normal, in these cases and the Claimant who received treatment and signed his/her name into the treatment record should be questioned either in EUO (Examination Under Oath) or a formal Deposition. The office personnel should also be questioned after the Claimant. The Claimant is usually the best focus for the investigation. Doctors are busy and they easily and effectively isolate themselves from suspect records and procedures relating to their creation. The “how, when, where, who and with what” questions should focus on how the entries were entered on the treatment record. Following are pertinent questions to have the Client ask the Claimant (first) and then the associated office personnel, in deposition.

QUESTIONS TO ASK IN DEPOSITION

The one question, which should always be asked of the Claimant, is: “did you ever sign your name more than once, on any one treatment visit?” This is the most important question, but there are many more questions, which can assist the document examiner and increase the reliability of the case evidence. For example: Where did you sign the record on each visit? Were you always standing, or did you sign in while sitting in the Lobby on some occasions? Who assisted you on each visit? Did you enter the date, as well as your signature? Did you ever enter more than one date, on any one visit? Who entered the date? Did you see them enter the date? Did you ever see future dates (or dates for future visits) on the record? Did someone give

you the pen to sign with or were there pens on the counter or in a cup, for you to use? How many pens were in the cup? What type of pen (or pens) was it (or were they)? What did the pen or pens look like? etc. Add questions to suit the case. These will usually provide sufficient support.

Ink Striation Analysis of Medical Treatment Records

The application of striation analysis involving the authentication of medical treatment records involves the combination of the identification of a specific pen, with the identification of the position of that pen, in the writer’s hand. Do you remember the striation characteristic, which referred to the position of the pen? The striations are caused by obstructions at the ball housing rim, which track with the rotational position of the body of the pen.

Finding the same unique striations in the same exact positions in the writings (at the same angles within the ink line and in the same stroke directions) in two or more writings is objective evidence that indicates a probability that these writings were made with the same pen, while held in the same position in the writer’s hand. We refer to these mirror position striations as “Linking Striations”.

See FIGURE 5 – Linking Striations Found in Signatures on a Medical Sign-in Sheet

When “Linking Striations” are found in several consecutive dated entries (signatures and or dates, for example) you have objective evidence, which can be mathematically evaluated by statistical probabilities. For example, when you have linking striations in four consecutive dated entries, the mathematical probability of this

occurring by chance is $1 / 207,360,000$. In other words, four consecutive dated entries signed with the same pen, held in the same position, will occur "once" in "two hundred seven million three hundred sixty thousand occurrences (of any four consecutive dated entries)". The equation is exponential and as the number of consecutive dated entries (with linking striations) increase, the probability becomes much larger and the objective evidence becomes that much stronger. Imagine what the number would look like from the seven consecutive linking striations, on the sign-in sheet shown on Figure 5 (at 120 to the seventh power).

MATHEMATICAL PROBABILITY FORMULA FOR LINKING STRIATIONS

The formula for computing the mathematical or statistical probability of finding linking striations in consecutive dated writings is:

$$P = 1 / x^n$$

Where:

P = The Mathematical Probability.

$1 / x^n$ is used because a probability is always a percentage of 1 and can never be greater than 100%.

x = The number of opportunities =

120

The number of positions, which the writer can select to hold the pen, 120 positions are used with a tolerance of 3 degrees*.

The (360^0) circumference of the round body pen is divided by 3^0 increments.

n = The Number of Consecutive Date Entries, which contain linking striations.

(i.e. number of signatures or dates, etc.)

***Note:** The " 3^0 tolerance" refers to a three degree rotational shift of the pen body in the fingers. This slight movement of the pen can occur during writing. A 3 degree rotational shift of the pen, equates to a striation movement of approximately one thousandth of an inch, in the ink line.

Using average ink line widths of 15 to 20 thousandths of an inch, this 3^0 tolerance accommodates adequate detection of movements and accurate measurements (or comparisons) of striation patterns, at 50X to 200X magnifications.

I had the simple probability formula presented above, verified by Dr. Friehl, a Professor of Statistics and the Head of the Mathematics Department at the University of California in Fullerton, on August 7, 1995. He told me the formula was correct and used properly. I got lucky. He tried to explain some more complicated formulas for use in different applications and I got lost. He was very gracious and gave me a book on Statistics titled "Probability and Statistics" by William L. Quirin, published in 1978 by Harper & Row.

Another probability consideration, which adds to the evidence, is the "selection of a specific pen", when several are available. This probability is additive to the case evidence and can also be significant. For example, if you have six medium Bic pens (all the same type and appearance) in a cup and you select the same pen on six different days in a row, the probability of 6 in a row = $1/6^6$ or $1 / 279,936$. Seven times = $1 / 1,679,616$.

“Habitual Rhythm Patterns”

Exhibited in the dated consecutive entries.

Another technique of analysis, which we put considerable research into, and have utilized in examination and screening of treatment sign-in sheets, is the “Habitual Rhythm Patterns” exhibited in the consecutive entries, down the entire sheet. I have examined many thousands of treatment sign-in sheets, using this technique of analysis. I have used it in all my medical claim cases as well as in screening of suspect treatment records. I have provided treatment record screening, as a free service for my Insurance Company Clients, for over ten years. I will only give a very brief overview of this analysis technique, in this article.

Conceptually, the overall appearance of the entries on the treatment record should exhibit random variations in the entries, in entire columns or rows, which correspond to the random day to day variations: of the office procedures; the people involved; the ergonomics involving the creation of the record (i.e.: sheet placements; positions when signing, dating, stamping, etc.), changes in people’s mood, energy, stress, patience, etc.; over some period of time. For example: signatures deposited on random days, over a couple months, should (typically) exhibit random variations in slant, size, length, form, placement, and density. The signatures should not typically, exhibit a “rhythm pattern” (or patterns) down the sheet. Rhythm, by definition implies (to me) “a developed or flowing motion or pattern.” This definition is not synonymous with “random variations” or single signatures placed on a document on random days. It takes some degree of continuous writing to develop rhythm. The extensive research and casework involving

columns of signatures and dates on sign-in sheets, has proven to me there are rhythm patterns, which strongly correlate with “multiple signing” (writing of multiples of signatures or dated writings, in single sittings).

Rhythm patterns, displayed in consecutive signatures (or dates), down an entire column, are indicators of possible multiple dated entries, in single sittings. Random variations in signatures and dates (mentioned above) are indicators of authenticity or authentic patterns of single date entries (in single sittings).

The left and right margins of signatures (or other written entries) are one of the prominent features (of many) to study, to determine which indicator/s are present. For example, a left (and right) signature margin that starts at the top of the sheet and moves down the sheet at a constant angle, in a straight line, until it ends at the bottom of the sheet, displaced two inches to the right of the starting position at the top, is a strong indication of one (or very few) sitting/s. A right (and left) signature margin set that has many position changes (subtle and pronounced) at random date positions, down the entire sheet, is a strong indication of authentic date entries that were entered on separate dates (and single sittings).

Rhythm patterns of grouped, multiple signatures or date entries, such as (# signatures per sitting = 1, 3, 4, 3, 3, 5 and 2) are common. These grouped multiple entries produce a right margin pattern that undulates in and out down the sheet. A popular undulating right margin pattern, which we call a “Saw-tooth Pattern”, moves down and out to the right, further and further to the right as it moves down (at a somewhat constant angle) until it reaches the end of that

signature group and then snaps quickly back in to the left (at a much greater angle than the outward right movement angle over the previous several signatures in that group). This pattern of gradual and constant outward movement, over several sequential signatures, followed by the quick snap back to the left (at the beginning of the next signature group) usually repeats down the sheet – and gives the appearance of a saw-tooth configuration. These undulating patterns usually cover three to five signatures at a time.

The relationships of the writing features of all the consecutive signatures (or entries) down the sheet, should be studied for possible rhythm indicators. The signature features of study include the: margins; slants; size, letter spacing, letter forms, letter placements, writing densities. A determination of authentic or non authentic rhythm pattern/s is based on all the combined writing features studies, down (or across) the entire sheet, column or row.

The rhythm studies should be coupled with answers from the depositions or other information regarding the creation of the suspect document. For example: if the Claimant has stated that he/she signed his/her name standing sometimes, sitting sometimes, and there were a couple times when laying on a therapy table; - but; all 25 dated signatures on the sign-in sheet look like a rubber stamp, down the entire sheet, with a constant left margin drift angle, then the rhythm pattern indicators are made stronger by the ergonomic discrepancies.

Habitual Rhythm Patterns are subjective evidence and must be given the proper weight. People are unique in their habits and some are more regimented than others. These rhythm patterns are useful: as indicators of authenticity

or multiple signing fabrication: in screening sign-in sheets, for candidates which warrant further investigation; or as supplemental supportive evidence; and sometimes, in rare cases, as stand alone evidence.

In screening of photocopies of sign-in sheets, without any knowledge of the case or document circumstances, we believe the proper study and application of Habitual Rhythm Indicators can range from 80% to 85% reliable (in general), in identifying a fabricated record. There is no absolute range and any specific case might contain higher than 85% reliable indications. Our studies indicate there are complex patterns, misleading patterns (ie: usually performed by regimented individuals) which can cause some misinterpretations. We are very conservative and feel that an 80% reliable indication, means that you can be wrong 20% of the time, in basic screening. I choose to be conservative and be wrong in calling a suspicious record inconclusive, or not worthy of further investigation. On these cases, I always advise the Client to base his decision to assign us, on the case evidence. "If it reads like a fiction novel, it may be."

The use of Habitual Rhythm indicators in case work can be far more conclusive, in some cases, such as the examples I gave earlier, where case or document related facts (ie: Depositions) add to the total evidence – or when all the habitual indicators on a sheet are strong, similar and involve more than one or two persons. I have seen sign-in sheets where the Habitual Rhythm Indicators were so strong that the likelihood of finding a authentic sign-in sheet with this many strong indicators (including supportive facts in some cases) may be one in a couple thousand (or more). These cases findings may be worthy of a

Probable or a rare Highly Probable finding, in my opinion.

For maximum reliability it is always best to couple rhythm indicators with other corroborative evidence, when possible.

UV - PHOTOGRAPHIC COLLECTION - MEDICAL TREATMENT DOCUMENTS

This necessary and effective photographic document collection process, was developed by Mr. Gil Garratt, a Forensic Photographer and Director of SignaScan, Inc. Gil performed the majority of document collections on the cases discussed earlier. On several occasions, while standing in line to request a medical record file, (to copy photographically), he witnessed a Patient sign three or four times on a treatment record.

The photographic collection of Documents, at the Clinic (or Doctors office) is required in these cases. The original record is very difficult to obtain. The Doctors very rarely give them up. You must have a very high resolution reproduction of the original document (or the original document itself) to perform striation analysis at 50X to 200X magnifications.

We use macro photography with UV exposure and high resolution color positive film. We photograph the signatures, dates, treatment check marks and occasionally other entries, in sections (or pieces of the document). The high resolution film and macro photographic process typically produces workable resolutions (for ink striation analysis up to 200 X magnification) and very effective UV ink discrimination (the resultant UV fluorescence from black inks, exhibit variations of gray, brown, purple and

black colors). The positive film allows for backlit microscopic analysis.

GENERAL RULES OF INK STRIATION ANALYSIS

► *You must have the original document or some adequate replication of the original document entries, which are to be analyzed.* The replicated data (i.e.: macro photographs; and/or digital images; of the writings and entries taken from the original document) should be of high enough resolution to afford adequate analysis of ink line striations at magnifications of 50X to 200X.

► *You should have a reasonably good photocopy of the entire document,* for: complete rhythm pattern studies; viewing of the document layout, construction, and all entries and writings; as well as the creation of exhibits for evidence presentations.

► *Ink Striation Analysis (measurements and overlay comparisons) should be performed within the range of 50X to 200X magnification,* for proper precision and accuracy. Measurements or overlay comparisons of striation patterns should be performed at the highest magnification possible, for the most accurate and reliable results.

► *Overlay comparisons (or measurement comparisons) for determination of "Linking Striations" should be made in the same angular position and direction of stroke, in both writing ink lines.* i.e. Comparing striations in consecutive date entries on a medical treatment record, to determine if the same pen was used while held in the same position, during these writings. See the examples of overlay

comparisons of Linking Striations shown on Figure 6. The images are a little vague because they were extracted from a training video, but hopefully, the process can be better understood by the visual presentation.

See FIGURE 6 – Overlay Comparison Analysis of Linking Striations

► ***Prominent and unique striation patterns should be selected for use in striation analysis and comparisons.*** The expert should attempt to select and use striation patterns which are prominent, well defined, stable (those which repeat in definition and location), recurring (appearing in the majority of the writing) and most unique in form (multiple lines of differing width and spacing, or some other unique feature/s). The striation patterns selected and used in analysis or comparison should contain an adequate quantity of the qualities mentioned above to provide reliable discrimination.

► ***The expert must determine the number of striation patterns required to make a reliable determination in any ink striation analysis procedure or case.*** She/he must use her/his judgment in determining how many striation patterns are adequate and appropriate to make a reliable determination.

This dilemma is very similar to the question “how many exemplars are required to make a reliable call of authenticity, of a questioned signature?” The expert must objectively use her/his knowledge, experience, the details of each specific case, and the supplemental evidence to make this determination. It is always better to use more striation patterns, when possible, to increase the reliability of the opinion. There is no absolute answer or magic number, which will

suit all cases.

► ***The expert must also determine if the striation patterns that are present are inadequate*** or too few in number for reliable analysis to be performed. If the striations are determined to be inadequate, they should not be relied upon or used as evidence in the case.

► ***Experience must be gained in how to properly identify striations, compare striations and interpret striation evidence.*** Proper ink striation analysis takes time to learn. Many hours of study of striation patterns and practice in using them in analysis, are required.

It is the responsibility of experts not only to “know their expertise well”, but also to “know what they don’t know well” and to utilize this knowledge with honesty and integrity.

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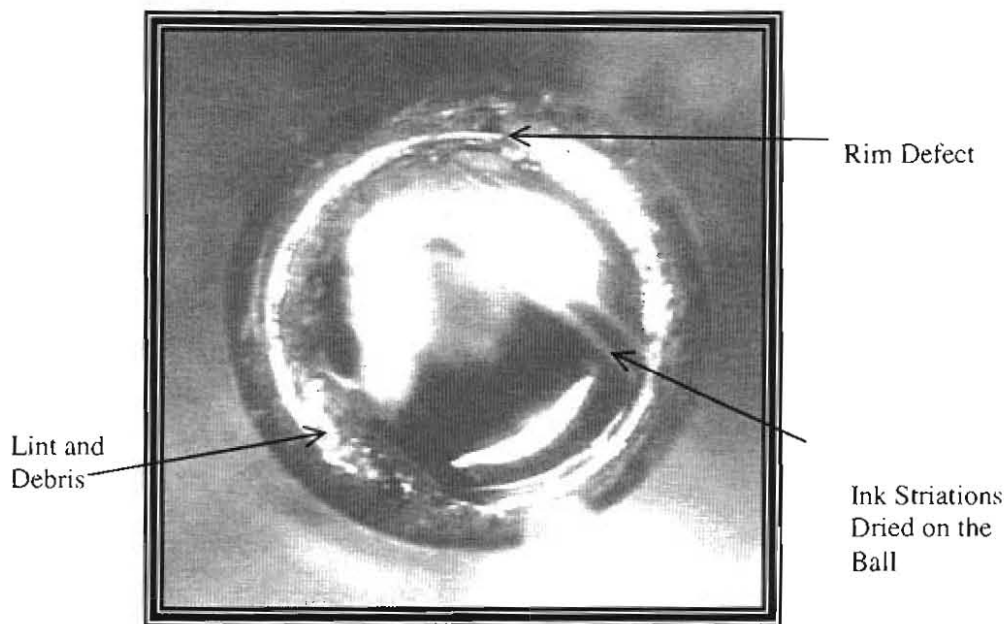
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John F. Cerlanek, CDE, MBA, BSIT has been a board certified member of NADE since 1997 and has served on the NADE Ethics Committee since 2001. Prior to the start of his career in Document Examination in 1987, he spent fifteen years in Industrial Engineering. John has since participated in intensive research and development activities, which have lead to five US Patents involving signature and handwriting analysis, time dating inks, specialized document examination equipment and scientific methods. He is a cofounder of SignaScan Inc., a Questioned Document Laboratory, incorporated in 1991, and remains the President of that company. John has worked over 3000 questioned document cases and has taught over fifty MCLE certified classes in document examination. John received his BS in Industrial Technology at CSULB and a MBA from Pepperdine University. Visit his company website at signascan.com for more information.

Magnified Ball Point Pen Tip Housing and Ball



Note the ball housing "rim defect" (a flattened location) at the top and the lint and debris wedged between the ball and the housing. These obstructions are primary causes of striations in the ink line. Striations are visible, in the ink residue on the ball surface.

FIGURE 1

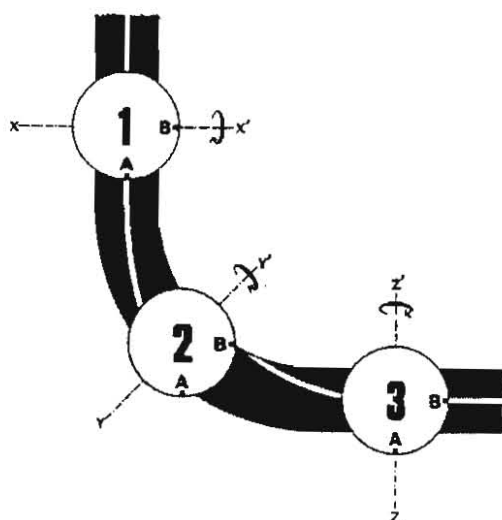


FIGURE 2

Reference: Snake, K.W., "Determination of the Direction of Ball-Point Pen Motion from the Orientations of Burr Striations in Curved Pen Strokes," *Journal of Forensic Sciences*, JFSCA, Vol. 25, No. 2, April 1980, pp. 386-389

The location of two ink (Burr) obstructions, A and B, are depicted with the resultant striations, in a curved stroke.

INK STRIATIONS POSITION STUDY

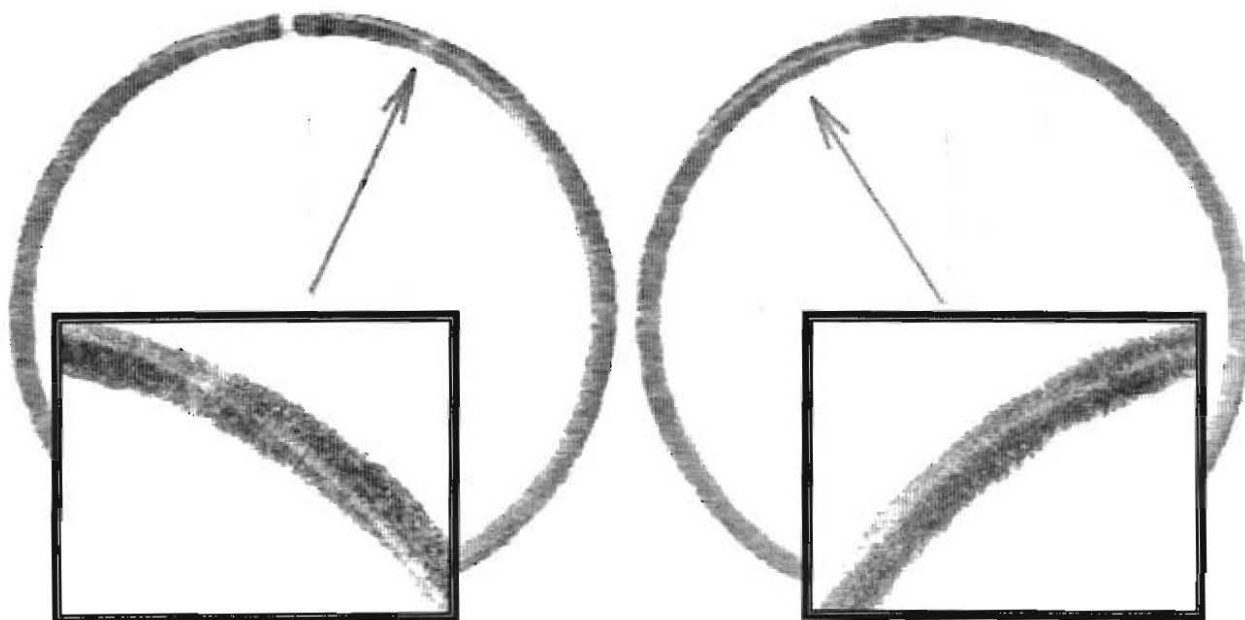


FIGURE 3

The two Circles were drawn counter-clockwise - starting at the top of the circles. The circle on the left was drawn first, then the pen was rotated in the hand (approximately 30 degrees) and the circle on the right was drawn.

The arrows are pointing to a prominent striation, which rotated in the ink line, with the rotation of the pen.

Magnified views of the circle segments, which contain the prominent striation, are superimposed.

STRIATION CARACTERISTIQUE DU BIC S-1

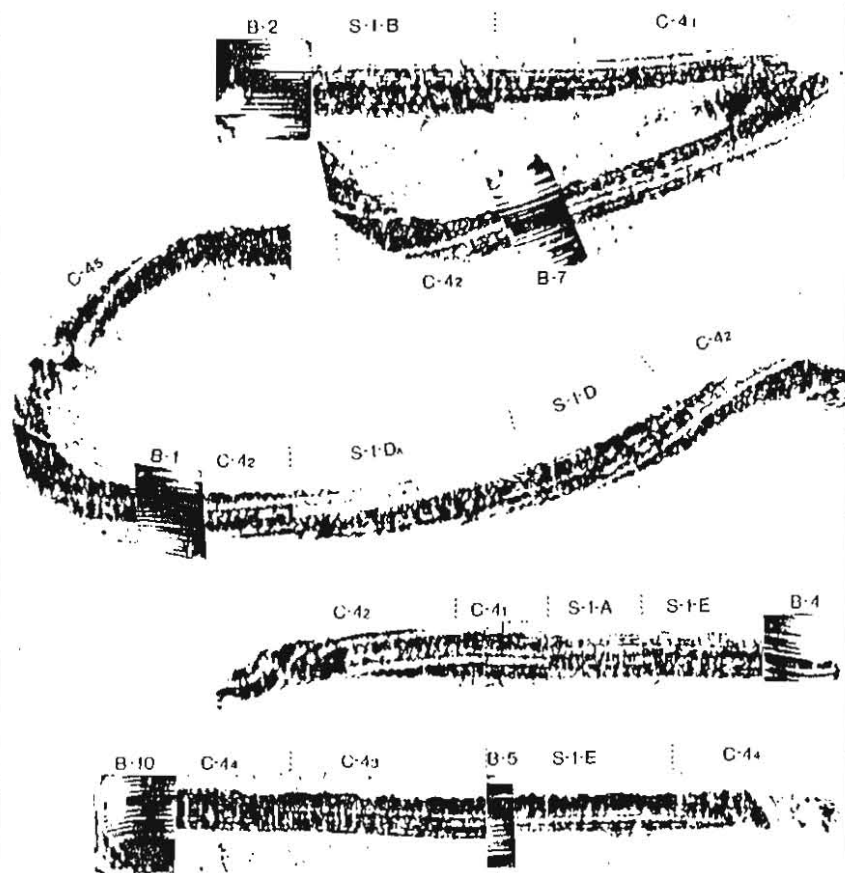
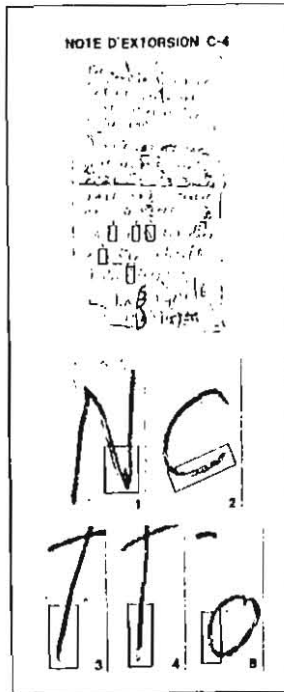


FIGURE 4. Mr. Poulin's "Blue Brigade Case" Exhibit, comparing ink striation segments in a Ransom Note with overlaid ink striation segments from a Ball-point Pen writing, to demonstrate a match. Images were captured at 25-35X.

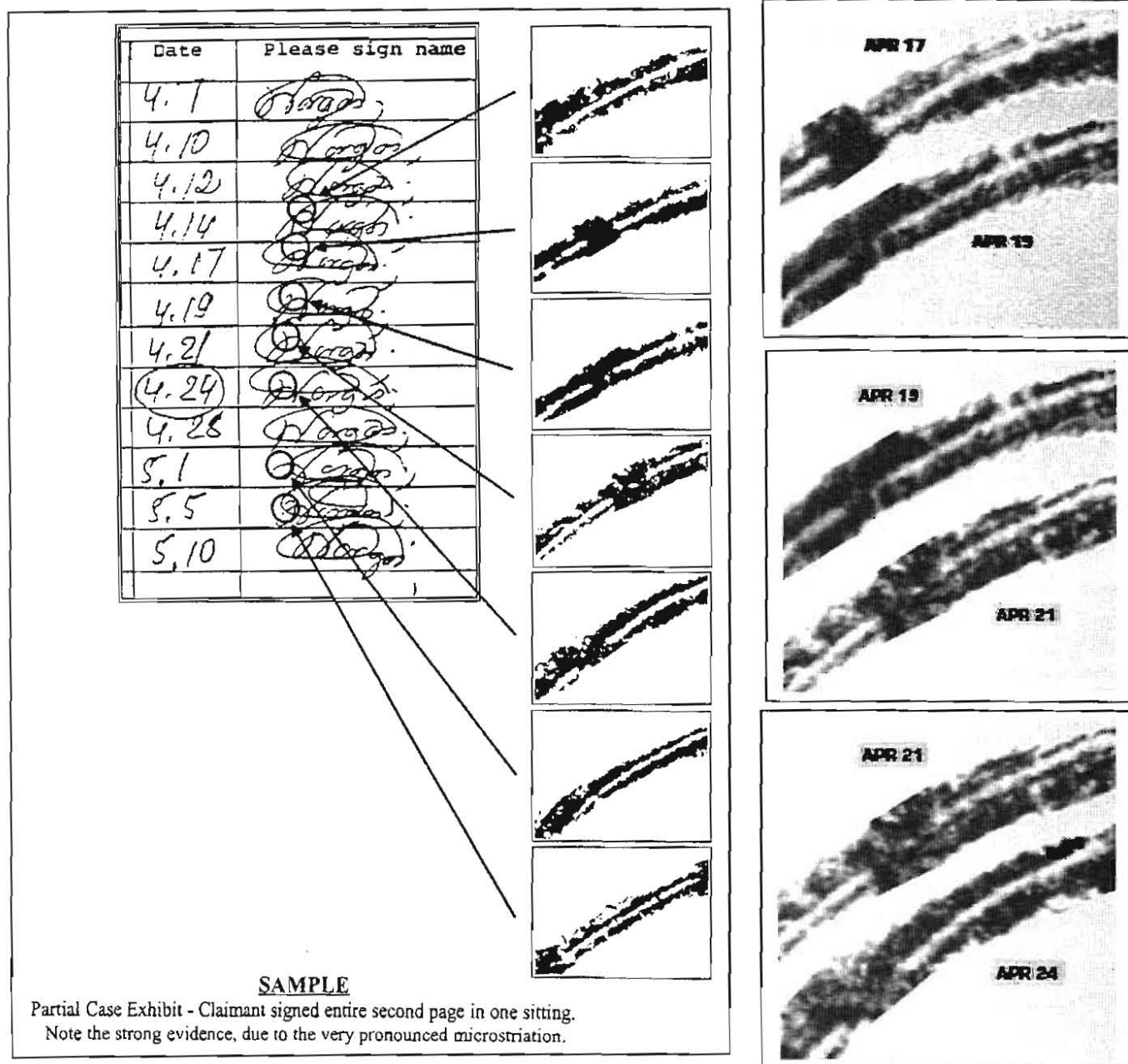


FIGURE 5 -
LINKING STRIATIONS FOUND IN SIGNATURES ON A MEDICAL SIGN-IN SHEET

The mathematical probability of picking a round body pen up (and writing with it) in the same identical rotational position, on seven separate days, is "1 chance in 120" to the 7th power (1/120⁷). Your chance of winning two consecutive state lotteries with two bets is much better.

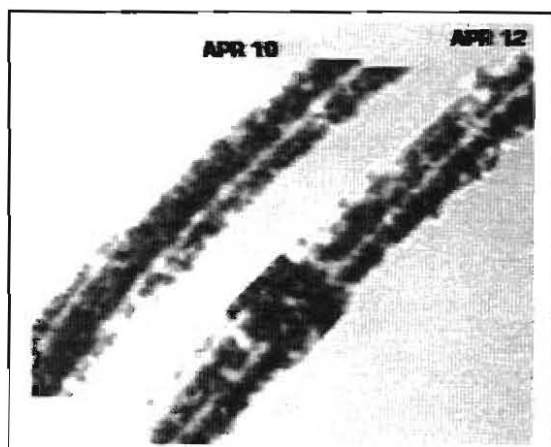
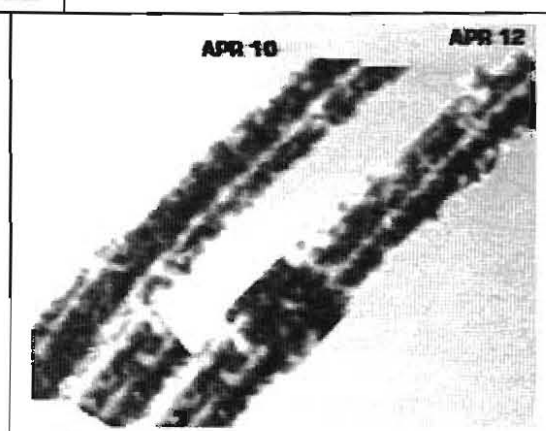


FIGURE 6a
OVERLAY COMPARISON ANALYSIS of
LINKING STRIATIONS

Images captured at approximately 120x

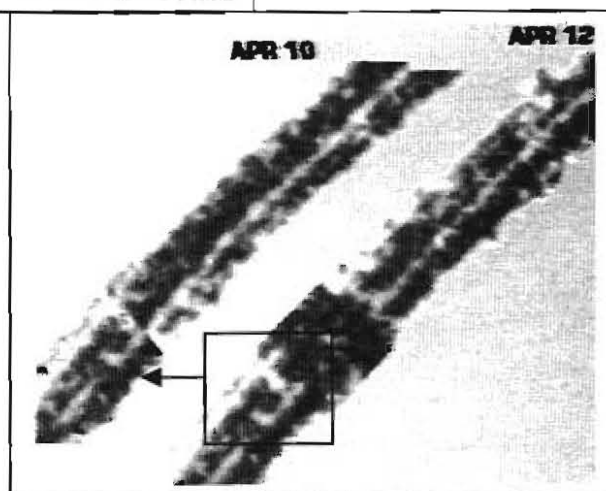
Two Signature
ink line Segments



Section from bottom
of April 12 segment is
copied and moved
over to April 10

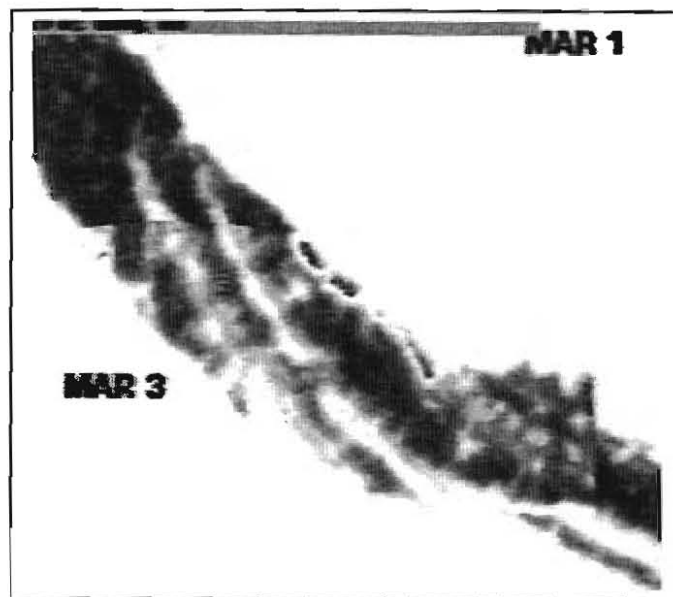


April 12 section on
top of April 10



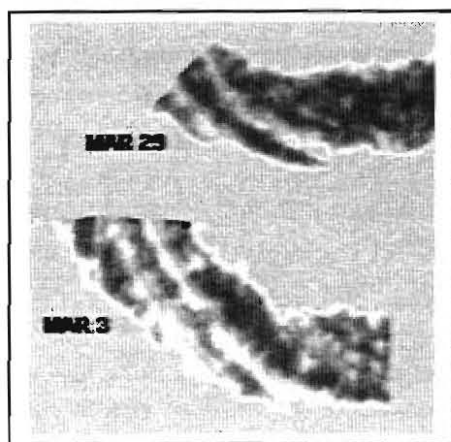


Two Signature ink line Segments

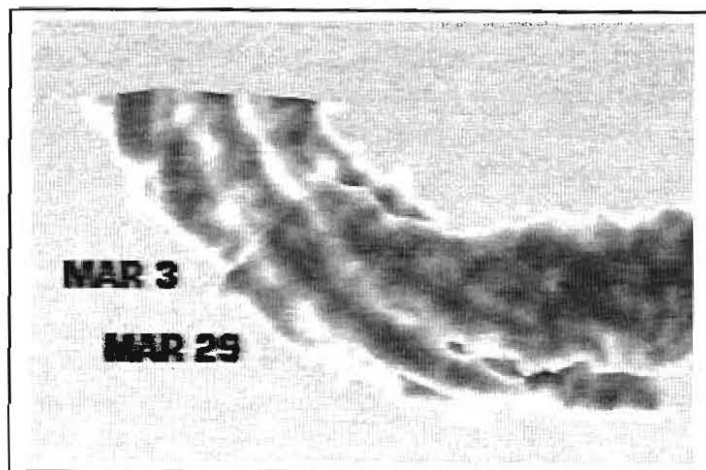


Mar. 3 segment on top of Mar. 1

FIGURE 6b
OVERLAY COMPARISON ANALYSIS of
LINKING STRIATIONS
Images captured at approximately 120x



Two Signature ink
line Segments



Mar. 29 segment on top of Mar. 3

THE AUTHORITIES SPEAK OUT ON PROPORTIONS

Compiled by

Kay Micklitz, CDE and Barbara Downer,
CDE

"The relation between the heights of the short letters and the long is an important characteristic of a handwriting, as it tends to remain unaltered, whether the writing be large or small, fast or slow and normal or disguised." Page 312

"Once fixed, the ratio of a handwriting is very seldom altered, and experiments have shown that it is extremely difficult deliberately to effect a consistent change without a complete loss of fluency." Page 313

Wilson Harrison, *Suspect Documents*, Nelson-Hall Publishers, Chicago, 1981

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"This is one of the more important elements of handwriting comparison. The exact size of basic letters, or parts of letters, is not the important comparison; rather, it is the relative size or proportion of letters to other letters, or parts of letters to other parts, that is of true concern..." Page 261

"Proportion is characteristic of a writer even though an attempt is made to disguise the form or slant, or change the size of the writings. Every writer subconsciously and consistently uses a chosen scale of proportion. Proportion may be the width of a letter to the height; the height of small letters relative to capital letters; the body of letters to the upper loops or lower loops." ... Page 263

"Moreover proportion also depends on the location of the letter in a word. ... In a disguised handwriting, many persons change the general size, but the proportion of the letters, being an unconscious habit, is most difficult to change." ... Page 263

"A letter may be written small or large, narrow or wide, but it is the relationship to the other letters that is most important. ... Proportion is the most important element in the examination of handwriting and is consistent even in disguised writing." Page 263

Russell R. Bradford and Ralph B. Bradford, *Introduction to Handwriting Examination and Identification*, Nelson-Hall Publishers, Chicago, 1992

.....

"The various parts of an ordinary signature when carefully measured bear a certain proportion to each other that with most writers is found to be surprisingly uniform..." Page 141

"Genuine writing or genuine signatures show a certain definite and fixed proportion of height of letters to length of words." Pages 141-142

Albert Osborn, *Questioned Documents*, Nelson-Hall Publishers, Chicago, 1929

.....

"It is fairly easy for a person who has a large writing to make it smaller and vice versa. But he (or she) will always maintain his personal ratio of extensions/middle zone height. This ratio is very difficult to alter or to imitate and maintain." Page 105 Renna Nezos, *Judicial Graphology*, Scriptor Books, 1994

.....

“What is of more importance in the letters is interse {between or among}. These usually yield useful results in the identification of handwriting in the case of some highly skilled writers. The height of the short letters in relation to long letters of majority of the writers remains fairly constant and has, therefore, a greater significance. ... The normal handwriting of some persons shows a certain fixed relation of proportion of height of a letter to its width, and in such cases it is often a useful factor in identifying the genuineness or otherwise of a particular handwriting.” Page 166

M.K. Mehta, *Identification of Handwriting and Cross-Examination of Experts*, 4th Ed., Fred B. Rothman & Co., S. Hackensack, NJ

.....

“Harrison... asserts that, to a great extent, the ratios of letters are maintained despite changes in size, speed, or intent of the writing (normal or disguised). Nevertheless, he holds that a similarity in ratios cannot, alone, be considered a reliable indicator of common authorship, but that a difference in ratios is a safe indicator of different authors.”

Page 103

Roy A. Huber and A.M. Headrick, *Handwriting Identification: Facts and Fundamentals*, CRC Press, Boca Raton, NY, 1999

.....

“Proportions usually are consistent in writing regardless of the size of the writing. When a writer changes the size of his writing, his letters remain proportional. Document examiners

compare the letters in each zone of writing. They compare the looped letters with middle zone letters. Capital letters are also compared to upper looped and lower looped letters and middle zone letters. Proportions include the horizontal expansion of the writing in relationship to the vertical strokes of the letters.” Pages 68-69

Katherine M. Koppenhaver, *Attorney's Guide to Document Examination*, Quorum Books, Westport, CT, 2002

.....

“Three terms have to be defined. The mid zone is the area where small letters without upper or lower parts go, such as small a, c, s, r. The upper zone is where the loops of b, l, k, etc. go. The lower zone is where the loops of g, y, z, etc. go. The imaginary line on which the mid zone letters sit is called the baseline. In studying size, we first describe how high the mid zone letters are and then how wide they are as compared to their height. We describe upper and lower zone letters in proportion to the mid zone size, as also the capitals. One can change the overall size of the writing a lot easier than one can change the proportions between the three zones or between the height and width of individual letters.” Pages 15-16

Marcel B. Matley, *Forgery: Detection and Defense*, San Francisco, CA, 1988

.....

“The standard of large and small writing is, in itself, of very secondary importance. What is very significant is the *proportion in size* between tall letters and small letters, and what is decisive is not so much the absolute proportion but the degree of variation in this feature of writing, as

in all features. The decisive factor is thus the variation which is detected in the same piece of handwriting or in several manuscripts of the same author, in the maintenance of the size between tall letters and middle-sized letters on the one hand, and small letters on the other hand, and between the small letters themselves. Page 63

Robert Saudek, *The Psychology of Handwriting*, George Allen & Unwin, Ltd. London, 1925

.....

"Relative heights of letters are the measurable differences in the heights. Height patterns are most readily identified in letters having upper extenders, although small letters also have patterns of height relationship. Letter height relationships have significance in identification because writers are not aware that they make certain letters higher than others or that they habitually do so. Letter heights reflect the unconscious range of movement of the fingers and hand. Height relationships are often inconspicuous and not likely to be duplicated in simulated or imitated writing." ... Page 100

"By using transparent grid plates, inconspicuous writer habits can be discovered in the relationship of heights..." Page 100

Edna W. Robertson, *Fundamentals of Document Examination*, Nelson-Hall Publishers, Chicago, 1991

.....

"Every letter of the alphabet has a different formation which can be measured in relation to the next letter. This is largely a matter of habit and is a reliable characteristic of individualistic writing." Page 167

J. Newton Baker, *Law of Disputed and Forged Documents*, The Michie Company, Charlottesville, VA, 1955

.....

"In the third experiment it was shown that it is difficult to modify the size of either the vertical or horizontal component without a proportional modification of the other." Page 327

"The main result of these present experiments is that... parameters involving... aspects such as size ratios of the writing do not allow decomposition [change, ed.], while those parameters involving... ambient aspects such as slant of the writing can be decomposed intentionally." Page 329

Herbert L Pick, Jr. and Hans-Leo Teulings, *Geometric Transformation of Handwriting as a Function of Instruction and Feedback*, *Acta Psychologica*, 54, 1983, North-Holland.

Disclaimer: This list is not intended or claimed to be a total and all-encompassing listing of all references to proportions by the referenced authorities, but is presented for your convenience and possible use and/or research in the field of document examination.

CASE NOTE

TOP TEN REASONS WHY THE BABE DIDN'T DO IT!

by

Ann Kessler, CDE

A client was interested in authenticating the signature of Babe Ruth on a baseball he had received in the 1930's when he himself was around 13 years of age. It was given to him by a cousin who had a friend who knew the then president of the American League (with whom Babe Ruth played most of his active career). There is no doubt that it is an authentic American League baseball* with the signature of the president imprinted on the ball with its traditional red and blue threads. But, unfortunately, it was not the genuine signature of Babe Ruth.

Research on Babe Ruth revealed that he had indeed been extremely generous with his time *and* autograph, particularly with children. Therefore, many of his genuine signatures are recorded, as well as the many forgeries. Eleven genuine exemplars were used for this examination (five are displayed here).

The baseball the client had received came in a cardboard gift box, which housed the baseball contained in a round plastic container that could be opened and resealed and sat on a beautiful gold stand. The examiner's opinion was in agreement with a letter the client had received from an auction house in Illinois, *Mastro Net, Inc.*, that the signature of Babe Ruth had probably been penned by someone on the "staff" of the American League. The baseball may have

value in its age and history, despite the lack of a genuine Babe Ruth signature.

TOP TEN REASONS WHY THE BABE DIDN'T DO IT!

10. Capital "B":

QD: Initial stroke of letter starts at baseline and moves upward to form the rest of the letter. The top lead-in slightly curved stroke was added after the rest of the letter was formed. Loops of the "B" are too narrow in comparison with the exemplars, and have a slowly drawn appearance.

E1,3,4,5: The capital letter "B" starts at the top with a "half-moon" shaped stroke that then moves down toward the baseline and up again to form the letter, with its wide balloon-shaped loops, in one smooth unbroken line.

9. Lower Case "a":

QD: Starts with an lead-in from the baseline, and is separated from the "B".

E (All): Wherever lower case a's appear, they lack lead-in strokes.

8. Lower Case "e":

QD: The "e" in Babe is made with a looped stem.

E (All): Wherever a lower case "e"

appears in any of the signatures and/or writings, they are formed in the shape of “miniature Greek E’s.”

7. Capital “R”:

All R’s, on the exemplars, are made with smooth free-flowing unbroken lines that resemble a backward “S.” The QD “R” also has the same shape but has a more “drawn” effect with a “warping” and patched like appearance at the top

6. Lower Case “u”:

QD: The “u” is connected to the “R.”
E1,3,4: These three show the u’s disconnected from the “R”.

E2,5: These exemplars show the “u” connected to the “R”. Note: In E2, Babe Ruth writes his real name of G.H. Ruth (George Herman) in an individualized connected style of using only 2 pen lifts. The disconnected stroke is made after the first side of the “H.”

5. Lower Case “h”:

QD: The top of the “h” is rounded with a retraced stroke at the base of the letter where it moves up to form the round lower portion terminating in an abrupt upward stroke.

(All): The tops of the h’s have delicately pointed tops with no retracing of the connected stem, and have angular lower portions and

slightly curved terminal strokes.

4. T-Bars:

QD: The T-bar is a heavily made elongated horizontal stroke with a spear like quality – thick beginning stroke that tapers to a finer point.

E All: T-bars have varying lengths with elongated strokes in E2, 3, and 4. E4 also has little ink deposits on both sides of the t-bar. The t-bars appear to have lighter beginning strokes and heavier endings.

3. Shape of Writing:

QD: All strokes leading to and from the baseline of writing are of a more angular shape, or pointed at the baseline, particularly in the last name.

E (All): All strokes leading to and from the baseline of writing are softly curved.

2. Pictorial Writing Appearance:

QD: The writing has a stilted, slowly drawn appearance with many pen stops and ink deposits.

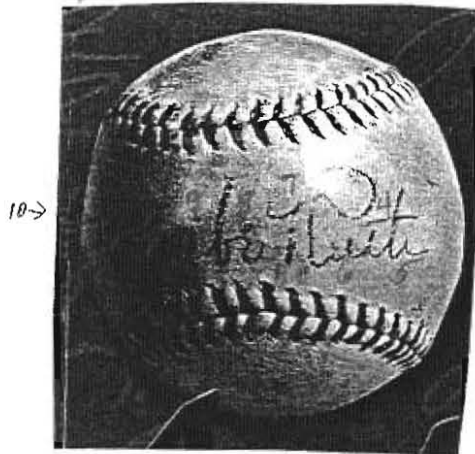
E (All): The writing is written rhythmically and quickly across the page (or ball) with smooth beautifully curved unbroken lines.

**And the Number One Reason
Why Babe Ruth Could Not Have
Signed the Questioned Ball:**

- 1. Quotation Marks!** On the questioned ball, quotation marks appear around the first name of "Babe." According to the authorities mentioned in this article, or in the Exemplar Sources, it has never been observed that the genuine signature of Babe Ruth contained quotation marks! And probably for a very good reason. Quotation marks imply a disassociation with the name. Other than perhaps signing legal documents with his "real" name, it is obvious, with the plentiful amount of his genuine signatures that he very much identified with the name of Babe. And why not – for he really was – The Babe!

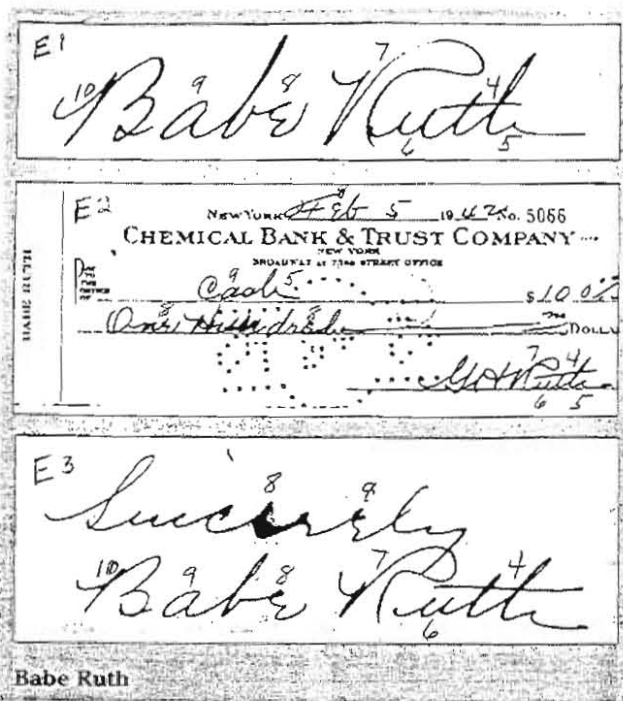
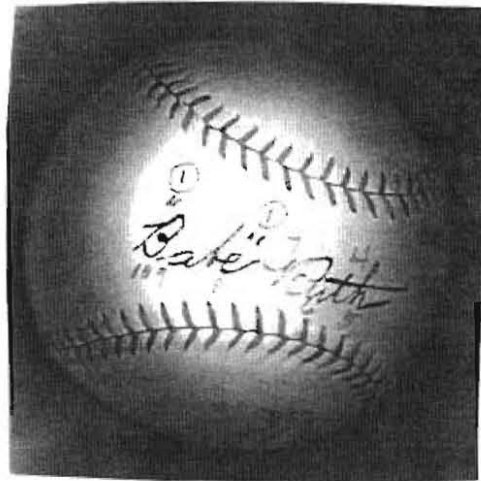
Ann Kessler has been actively involved in handwriting identification since the 1980's. She has completed three courses in Forensic Document Examination, one with Felix Klein of Manhattan, NY, and the other two with Andrew Bradley of Denver, Colorado. She joined NADE (National Association of Document Examiners) in 1998. Ann opened her own business called "Accurate Analyses" in 1999 where she specializes in forgery cases, harassment and poison pen letters. She is court qualified in Florida, has taught handwriting identification courses; lectures and conducts workshops. She has written and self-published two books: "Accurate Analyses" and "Who Really Invented the Alphabet."

E5 Exemplars



Because of copy is uncertain whether the "R" is separated from the "u"!

Questioned Document



Ruth, Babe-(1936) d. 1948

3 X 5	750.00
8 X 10 Photo	2500.00
Canceled Check	1600.00
Single Signed Ball	5500.00

Research & Exemplar Sources:

Collier's Encyclopedia/P. F. Collier & Son Corp. 1956
 Advanced Autograph Collecting/Mark Allen Baker/Krause Publications, 2000
 Autographs/Staff of Beckett Publications, 1999
 Handwriting Analysis/Andrea McNichol/Contemporary Books, 1991

CASE NOTE

HANDWRITING EXPERT'S TESTIMONY IN BANKRUPTCY COURT

by

Robert C. Furr, Esquire

and

Shirl Solomon, CDE

The trial of Buyer vs. Seller/Debtor was held in the United States Bankruptcy Court in West Palm Beach, Florida on August 1, 2003. This handwriting expert was called to testify to the authenticity of the debtor's signatures on documents involving the purchase of a house, which was occupied by the buyer pre-petition, and on which the debtor refused to close. The debtor denied signing this document. The expert had previously testified in the civil trial involving the same principals. The State Court had ruled in favor of the buyer, ordering that she not be evicted from the house that she had contracted to buy from the debtor. When the seller, a man with whom she had lived for a number of years, later filed for bankruptcy, the question of the house's title again came into play. The filled-in information on the contract was admittedly handprinted by the buyer and bore her original signature. The document was then photocopied. The original and photocopy were then purportedly signed by the seller/debtor. Ergo, there existed an original document bearing the original signatures of buyer and seller/debtor, and a photocopy bearing

the photocopied signature of buyer and an original signature of seller/debtor. The seller/debtor disclaimed his signature on both documents.

The handwriting expert/document examiner had compared the questioned signatures with twenty-one exemplar signatures of debtor/seller, the dates on which ranged from contemporaneous to eleven years prior to the questioned documents. The examination revealed no unexplained differences of handwriting habit between the questioned and known documents. The laboratory equipment used in this assignment included a Meiji stereoscopic microscope, transmitted light box, ultraviolet lamp for side lighting, alignment grids, computer, scanner, Adobe Photoshop software and a photocopier. A written report was submitted to the court with the opinion that the two signatures were authentic. The following common characteristics were listed in support of the opinion.

Common Characteristics between Questioned and Known Signatures

1. Height relationship of capitals and middle zone letters.
2. Spaces between letters.
3. Speed and writing fluency.
4. Up and down stroke shade and pressure contrast.
5. Letter designs.
6. Rigidly abrupt "d" endings.
7. Writing slant (measuring regularity and irregularity with signature.)
8. Letter connections and detachments.
9. Shape of baseline strokes.
10. Placement of signature on baseline.

A computer-generated color comparison

sheet of the two questioned signatures and eight exemplar signatures was made and proportionately enlarged on a mylar treated poster for court demonstration. (See figure 1)

The testimony to be given was not complicated. The signatures had a voice of their own. The expert witness had only to demonstrate them to the court and point out the salient matches of the known and questioned signatures. During voir dire, however, the seller/debtor's attorney objected to the testimony being admitted. A nine-level standard was cited, allegedly adopted by the American Board of Forensic Document Examiners, one of the many existing professional organizations. Allowing for the court reporter's errors in recording, quoted here is debtor counsel's statement from the transcript describing the nine-level standard. "It states that first there's an identification, a determination of strong probability, then whether it's probable, any indications or evidence to suggest that this is the signature, five is no conclusion, six is indications did not, seven is probably did not, eight is strong probability did not, and nine is elimination. She (referring to the handwriting expert) has not stated that this is the standard that she uses."

In convincing the court to admit expert's testimony, buyer's counsel argued against seller's counsel's objections, stating "The Federal Rules of Evidence certainly set forth that a court could consider evidence from experts on technical, scientific and other specialized knowledge. And specialized knowledge is what this is, judge. It may not be as scientific as DNA, but it is specialized knowledge. I don't believe the courts could get through many of these without these sort of experts..." The court

ruled that the testimony of the handwriting expert be admitted, and the buyer won her case.

In this trial, the question of whether handwriting analysis is a science was not the determining factor in admitting the expert's testimony. The court had viewed the Curriculum Vitae indicating the expert's training, experience in her field and the names of attorneys who had retained her services. He agreed with buyer's attorney that an expert can be qualified in a specific field, whether that field be scientific, technical or specialized knowledge.

Writing that appears on a document is a tangible piece of evidence. The handwriting expert's testimony can make the attorney's case – but first, the attorney must convince the court to admit it.

References:

Iowa Law Review (1996), Science and Nonscience in the Courts: Daubert Meets Handwriting Identification Expertise.

Robert C. Furr, Esquire is an attorney in Florida and is a Board Member of the National Bankruptcy Trustees.

Shirl Solomon, CDE is a member and Diplomate of the National Association of Document Examiners. She has been a document examiner for more than thirty years.

COMPARISON SHEET 1

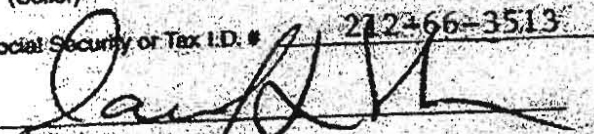
Q1 5/11/01 Contract for Sale & Purchase

could be accepted by the parties in a particular transaction and bargaining positions of all interested persons

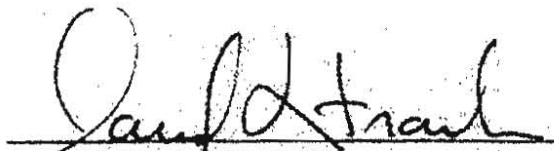

(Seller)

K1 11/30/99 (Exh A) R.E. Contract (Orig)

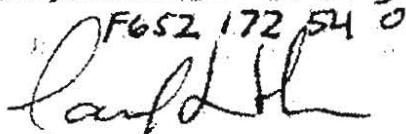
(Seller)

Social Security or Tax I.D. # 212-66-3513

(Seller)

K2 1/11/00 General Release (Orig)

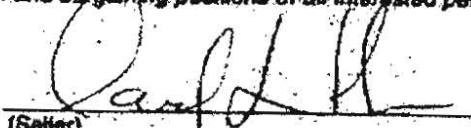

DAVID L. FRANK

K3 May/Jun 01 Mailing Address Chg. (Orig)

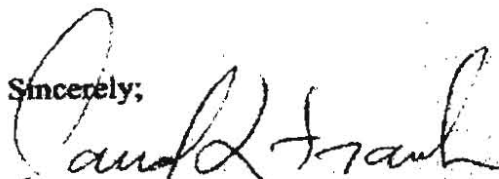
F652 172 54 0


Q1 5/11/01 Contract for Sale & Purchase

could be accepted by the parties in a particular transaction and bargaining positions of all interested persons

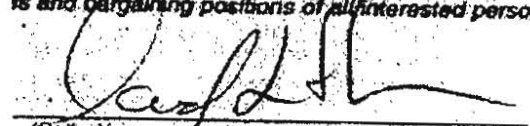

(Seller)

K4 1/27/98 Vada Corp. Req. for Funding (Orig)

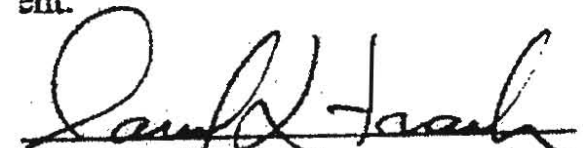
Sincerely,

David L. Frank

Q1a 5/11/01 Pc of Q1 w/orig Sig. of Mr. Frank

could be accepted by the parties in a particular transaction and bargaining positions of all interested persons


(Seller)

K6 1/11/00 Residence Settlement Agree. (Pc)
ent.


David L. Frank

K7 3/25/96 Vada Corp. Ch. #198 (Orig)

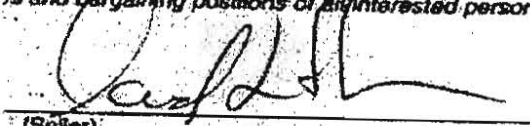

DAVID L. FRANK

K8 12/11/95 Ch. #114 (Orig)


0114 00000 20000

Q1a 5/11/01 Pc of Q1 w/orig Sig. of Mr. Frank

could be accepted by the parties in a particular transaction and bargaining positions of all interested persons


(Seller)

K5 9/26/97 Temp. DL Permit (Orig)

CLASS: E MTCY ONL
TEMPORARY PERMIT DUPLICATE 00-00-000
OPERATION OF A MOTOR VEHICLE
CONSTITUTES CONSENT TO ANY SOBRIETY TEST REQUIRED BY LAW A
CONSENT TO THE RELEASE OF DRIVING RECORDS REQUIRED BY LAW.
X 
any alteration voids this permit.

FORENSICALLY SPEAKING

+The early Minoan culture had a hieroglyphic writing. In the Middle Minoan period there appeared a pictographic script called "Linear A."

At the beginning of the late Minoan period, a new script called "Linear B" emerged.

+Epigraphy is a word that means inscription. Early writing was done on hard materials: stone, clay, metal, bone, ivory, sun-dried brick. Once paper-like materials developed, epigraphy became less used. Exotic epigraphy can be seen in the Mayan, Toltec and Aztec art, in China and on Easter Island. Practically every culture relied on epigraphy: Sumerians, Greeks, Etruscans, Celts, and Germans. In today's world we see epigraphy in monuments, cornerstones, tombstones and building fronts.

+Cuneiform, a system of writing by wedge-like strokes impressed with a stylus on wet clay tablets, developed in Sumeria. This script was also used outside Mesopotamia.

+Sir Henry Rawlinson copied and interpreted Old Persian inscriptions that depicted Darius I in bas-relief, by scaling a 300' rock in Behistun, Iran. The significance of this is that he made it possible to decipher not only Assyrian text, but also all cuneiform inscriptions. This inscription also included Babylonian and Elamite cuneiforms, and is one of the greatest inscriptions in history.

+Ararat, name of two mountains in central eastern Turkey, had its language written in cuneiform with no relation to any other language. The Inca did not have writing.

+The ancient Germanic alphabet, suggested by

the Greek cursive script and first used by the Goths, was called runes. Runic manuscripts were used in England and Scandinavia.

+Ogham was the ancient alphabet of the British Isles, especially Ireland, and can still be seen on gravestone inscriptions. The Runes (above) and the Ogham were the European alphabets of the late Roman era.

+Calligraphy has been consistently practiced in China as a fine art. It began with "chancery script," a simple seal script with varying stroke widths and sharp endings. The Chinese started using calligraphy 5th century B.C. The Japanese started using it in the 7th century A.D.

+Cyril and Methodius were brothers and Greek missionaries to the Slavs c.800. The Cyrillic alphabet, used in Bulgaria, Serbia and Russia, is traditionally ascribed to Cyril. It is an augmented Greek alphabet.

+A manuscript is a handwritten work as distinguished from printing or typescript. The oldest manuscripts were on papyrus. The earliest extant dates from c.3500 B.C. Papyrus was very gradually superseded by parchment (untanned animal skins) that could be written on both sides. Vellum was a very fine grade of parchment, and was often dyed purple for important manuscripts.

+The decoration of manuscripts with colored and metal pictures or designs is called illumination. The oldest come from Egypt found in tombs. By the 2nd century A.D. long papyrus roll was replaced by parchment codex (leaved book).

+A palimpsest is a parchment manuscript that

has been erased and reused.

+From the 10th to the mid-13th century, Egypt was the center of arts and calligraphy. This was the period in which calligraphy, bookbinding, papermaking and illumination were developed. The Kufic script was animated by floriated, interlaced and anthropomorphic designs. The sloping script most commonly used today, Nastaliq, was developed in the 15th century.

+Egyptian hieroglyphics were used on walls not only as decoration, but also as records of historic events. Jean Francois Champollion, a French Egyptologist, established the principles for deciphering hieroglyphics by use of the Rosetta stone. The Rosetta stone resides in the British Museum in London.

+Alphabetic writing based on the Phoenician script became widespread during the Industrial Revolution, mid 18th century, when the casting of iron developed.

Forensically Speaking is a column compiled from the research of Phyllis Cook, B.S, BCDE and Diplomate.

Editor's Note: This current column is the last in a series concerning the historical and cultural development of handwriting. The future Forensically Speaking column will present recent developments and new technology in the field of questioned document examination.

SUBMISSION GUIDELINES

Types of Papers Accepted:

1. Research papers report original, primary research in any area of QDE.
2. State of the Art Reviews survey the published literature on a specific topic in the field of QDE.
3. Case Reports present one particular aspect of a QDE case which is no longer subject to litigation or confidentiality. It is the responsibility of the author to obtain any required permission for use of material submitted. Should any litigation arise from improper use of materials, the liability belongs to the individual author, not to NADE.
4. Technical Reports discuss a single topic regarding equipment or methodology.
5. Letters to the Editor offer brief, specific comment on a current issue or on a paper previously published in the Journal.
6. OpEd (Opinion/Education) pieces set forth an opinion, pose a question, or inform about some aspect of QDE.

All papers must include references to support assertions and must present some information or viewpoint regarding some aspect of QDE which would be of value to readers.

The Editorial Board has avoided setting rigid guidelines for style and format. For example, both endnotes and footnotes are acceptable; bibliographic citations may follow standard sociological practice or legal practice, or other acceptable practice.

Authors may in general follow any standard style manual. That published by the U.S. Government Printing Office is recommended, since it is regularly up-dated and readily available. Papers should, however, have these features:

Method of Submitting Papers:

1. Send four (4) printed copies and one (1) 3.5" diskette with the article in a Microsoft Word file to Barbara Downer, Editor. Alternatively, submissions may be sent in Microsoft Word as an e-mail attachment to Barbara Downer at documentexam@earthlink.net. It is preferable to receive the articles in Times New Roman font, 12 pitch, single column.
2. As part of the above, submit one camera-ready print copy or electronic file of each exhibit or illustration you intend to have in this paper. If you desire to submit illustrations electronically, contact the editor in advance to discuss format. Each illustration should have a figure number by which it is referred to in the paper, and a caption or text, which succinctly identifies it and states its purpose.
3. Deadlines for the next two issues are February 1, 2005 and June 1, 2005.
4. It is highly recommended that you begin the process of writing your paper by discussing the potential for publication with one of the editors via email, telephone or letter. Contact information can be found at the front of the journal. This discussion will take the place of submission of an abstract.

Style and Format:

1. Title of the paper centered at top
2. Name(s) of author, and if multiple, the one(s) who will deal with the Editorial Board should be clearly indicated.
3. A brief professional bio of the author including degrees, certifications and relevant professional information.
4. The paper should have clearly demarcated sections. There are no rigid requirements in this regard, only that it should be logically developed and helpful to the reader.

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